RESULTS OF FISHERIES AND OCEANS CANADA'S 2014 ASIAN CARP EARLY DETECTION FIELD SURVEILLANCE PROGRAM

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2016

Canadian Manuscript Report of Fisheries and Aquatic Sciences 3103

Canadian Manuscript Report of Fisheries and Aquatic Sciences

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Cat. No. Fs97-4/3103E-PDF ISBN 978-0-660-05835-1 ISSN 1488-5387

Correct citation for this publication:

Marson, D., Gertzen, E, and Cudmore, B. 2016. Results of Fisheries and Oceans Canada's 2014 Asian Carp Early Detection Field Surveillance Program. Can. Manuscr. Rep. Fish. Aquat. Sci. 3103: vii+ 59p.

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ABSTRACT

In 2014, an early detection field surveillance program for Asian carps in the Great Lakes and its watersheds was continued for a second season by Fisheries and Oceans Canada's Asian Carp Program. The field program built upon the early detection sites selected in 2013, and continued to identify sites to monitor that were high risk for Grass Carp (*Ctenopharyngodon idella*), Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*H. nobilis*) and Black Carp (*Mylopharyngodon piceus*) arrival and establishment in the Great Lakes. In the spring, summer, and fall of 2014, 745 sites were sampled at 36 locations on the Canadian side of the Great Lakes (lakes Superior, Huron, Erie, and Ontario). Several gear types were used to capture fishes, including: boat electrofishing units, fyke nets, hoop nets, seine nets, tied-down gill nets, trammel nets, trap nets, and trawls. A total number of 43,928 fishes representing 92 species were captured. Surrogate species for Asian carps (Buffalo spp., and Common Carp) were detected in all gears except for seines and trawls. A total of 346 Buffalo species (*Ictiobus spp.*) were captured, and 1774 Common Carp (*Cyprinus carpio*). One triploid Grass Carp was captured in the Grand River on September 23rd, in a trammel net. Although new early detection locations were scouted and sampled, not all will be carried forward as long-term monitoring sites. Additional sites will be scouted in the Huron-Erie corridor, and in eastern Lake Ontario in 2015.

RÉSUMÉ

En 2014, pour une deuxième année, un programme de surveillance pour la détection rapide sur le terrain des carpes asiatiques dans les Grands Lacs et leurs bassins versants a été mis en œuvre dans le cadre du Programme sur la carpe asiatique de Pêches et Océans Canada. Le programme de surveillance sur le terrain s'appuie sur les sites de détection rapide établis en 2013 et on continue à établir les sites réputés à haut risque à surveiller pour la présence de la carpe de roseau (*Ctenopharyngodon idella*), de la carpe argentée (*Hypophthalmichthys molitrix*), de la carpe à grosse tête (*H. nobilis*) et de la carpe noire (*Mylopharyngodon piceus*) et leur établissement dans les Grands Lacs. Au cours du printemps, de l'été et de l'automne 2014, des échantillons ont été prélevés à 745 sites situés à 36 emplacements se trouvant sur la portion canadienne des Grands Lacs (lacs Supérieur, Huron, Érié et Ontario). Plusieurs types d'engins ont été utilisés pour capturer des poissons, notamment des dispositifs de pêche à l'électricité, des verveux, des sennes, des filets maillants fixés, des trémails, des filets-trappes et des chaluts. Au total, 43 928 poissons représentant 92 espèces ont été capturés. Tous les types d'engins ont capturé des espèces de substitution de la carpe asiatique (des buffalos *Ictiobus spp.* et des carpes communes), à l'exception des sennes et des chaluts. Au total, 346 buffalos (*Ictiobus spp.*) et 1 774 carpes communes (*Cyprinus carpio*) ont été capturés. Une carpe de roseau triploïde a été capturée dans la rivière Grand le 23 septembre à l'aide d'un trémail. Bien que de nouveaux sites de détection précoce aient été repérés et échantillonnés, seulement quelques-uns d'entre eux feront l'objet d'une surveillance à long terme. D'autres sites seront repérés dans le corridor Huron-Érié et dans l'est du lac Ontario en 2015.

INTRODUCTION

The focus of Fisheries and Ocean's Canada's (DFO) Asian Carp Program is to prevent the entry and minimize the impacts of non-indigenous Asian carps in the Great Lakes through outreach, early warning, response and management. The Asian Carp Program's early detection surveillance field sampling program was developed in the winter of 2012 and sampling was initiated in spring of 2013 (Marson et al. 2014). The early warning pillar of the program involves extensive sampling using traditional fisheries sampling gear. The early detection of aquatic invasive species is an essential component for the prevention of their establishment in the aquatic environment, as the sooner a species is detected, the more management response actions are available to address the issue (Lodge et al. 2006; Vander Zanden et al. 2010). Using a variety of fish sampling equipment and techniques, the early detection field program surveys sites that have been identified as the most attractive and suitable for Grass Carp (*Ctenopharyngodon idella*), Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*H. nobilis*), and Black Carp (*Mylopharyngodon piceus*), as well as those sites that are at highest risk for arrival and establishment of Asian carps in the tributaries of the Canadian side of the Great Lakes (Cudmore et al. 2012). From May 5th to October 30th, 2014, 36 wetlands, tributary rivers, and interconnected waters were sampled by the Asian Carp Program's early detection surveillance field program in the Canadian waters of the Great Lakes (Figure 1). The fish community present in each area was sampled, with a focus on the collection of Asian carps and surrogate species.

METHODS

Using environmental conditions and the ecological needs of Asian carps, computer modelling identified the areas of the Canadian waters of the Great Lakes most suited to, or attractive to, these species (Cudmore *et al.* 2012; methodology from N. Mandrak, unpublished). High and medium matches were selected as potential early detection surveillance sampling sites.

In 2014, the focus extended from the sites already selected in the 2013 sampling, which was focused in lakes Huron and Erie. In addition to the 24 early detection sites sampled in 2013, additional sites were scouted and sampled to determine whether they were actually suitable for Asian carps, and if they were amenable to traditional gear sampling. Overall, 36 sites were sampled in 2014, an additional 12 sites from 2013, including two tributaries in Lake Superior, three in Lake Huron, one in Lake St. Clair, two in Lake Erie, and four in Lake Ontario (Figures 1-35). Field crews were based out of Burlington and Sault Ste. Marie, Ontario.

Eight gear types were used to sample the early detection surveillance sites, including boat electrofishing units, fyke nets, hoop nets, seine nets, tied-down gill nets, trammel nets, trap nets, and trawls. The variety of gear types were used to target both large-bodied and small-bodied fishes in a variety of habitat types. Sampling the full breadth of the fish community ensured the greatest likelihood of detecting all four species of Asian carps, at both juvenile and adult life-stages. Descriptions of each gear type and their total effort are found below.

BOAT ELECTROFISHER

Boat electrofishing for the 2014 early detection surveillance program was conducted using two sizes of Smith-Root Electrofishing vessels. The Burlington crew operated with a 21' extra-heavy duty model, with a 7.5 kilowatt Generator Powered Pulsator, and dual-anode boom. The Sault Ste. Marie crew operated with a 14' Smith-Root vessel, with a 5.0 kilowatt Generator Powered

Pulsator, and dual-anode boom. Both crews operated with two netters who would retrieve stunned fishes and transfer them into a live-well in the boat. Sampling effort was recorded in seconds shocked for each site. Electrofishing effort for the Burlington crew was standardized to approximately 600 seconds per site. The Sault Ste. Marie crew shocked for more seconds per site, as the catch rates were lower in the tributaries they were sampling.

FYKE NET SAMPLING

Box fyke nets with a 0.32 mm ace mesh size, 0.61 m hoop diameter, 0.61 by 4.6 m lead length, and 0.61 x 1.3m wing length were deployed. A modification for the fyke nets in 2014 was to add a 10.16 cm square nylon mesh to the net entrance to reduce the catch of large snapping turtles. Fyke nets were set in wadeable habitat (<1.5 m water depth), with low or no flow, and on a variety of vegetation and substrate types. Fyke nets were set with the lead against shore and the net pulled taut perpendicular to the shoreline. When the water depth was greater than the net depth, a float was placed within the bag end of the net (codend), to ensure that turtles had access to air. Fyke nets were generally set for close to 24 hours and effort was recorded as the number of hours the net was deployed.

SEINE NET SAMPLING

A bag seine 9.14 m long, 1.52 m tall, with a mesh size of 3.18 mm ace mesh in the bag and 4.76 mm ace mesh on the wings was used for sampling wadeable habitats in low flow, with moderate vegetation. In flowing waters, seining was performed in the direction of the flow. Captured fishes were transferred into bins filled with water. Water depth and obstructions in the nearshore habitats limited the number of sites that were seined. Seining was used to target small-bodies fishes.

TIED-DOWN GILL NET AND TRAMMEL NET SAMPLING

Tied-down gill nets and trammel nets were deployed and fished in the same manner. The nets were deployed in lengths of either 182.9 m or 274.3 m, with inner gill-net mesh sizes ranging from 7.62 cm to 10.16 bar mesh (15.24 cm to 20.32 cm stretch mesh sizes), and net depths of 3 m. The trammel nets differ from the tied-down gill nets in having two additional panels of netting that sandwich the inner gill net panels. The outer netting is 45.72 cm bar mesh nylon netting that works to bag large-bodied fishes in the net (those too large to be gilled in the inner monofilament gill netting). The nets were used to target large-bodied fishes. Trammel nets were set for a short amount of time (approximately 30 minutes) in order to minimize the entanglement time of fishes. The nets were deployed in a way that would block off suitable habitat for Asian carps. The net is set to the shore and run perpendicular out from shore approximately 20-30 m, the boat is then turned and 120-214 m of net is deployed parallel to shore, and then the final 20-30 m is deployed perpendicular back into shore. This deployment technique blocks fishes into the encircled area. Heavily vegetated areas could be sampled, but the net would have to be deployed on the outer margins of the heavy vegetation so that it would deploy properly and cover the full depth of the water column. Setting the net in very heavy vegetation would limit its effectiveness as the lead-line would not always push through the vegetation, and would be held up off bottom, allowing fishes to escape below the lead-line. Once the net is set, the crew enter the blocked off area with the boat and use its motor and modified plungers to "pound" the area. By revving the engine, banging the hull of the vessel, or pounding the water's surface with plungers, the crew actively chases fishes in an attempt to get them to flee into the direction of the net. This method, referred to as "pounding" was developed by researchers working in the Mississippi watershed on the removal of Asian carps, which are known to be net avoidant species (ACRCC 2014). This sampling method provides several advantages over traditional gill

netting methods, including reduced set times (reducing stress on captured fishes), increased catch of sedentary fishes, and an increased number of sites sampled per day. Sampling effort was recorded as both the length of the net used and the amount of time the net was actively fished (in minutes).

HOOP NET SAMPLING

Six foot diameter hoop nets, with an overall length of 6.71 m, with two funnels and 6.35 cm bar mesh, were used to sample flowing water in depths greater than 3 m. Hoop nets were deployed in habitats that could not be sampled by other gear types, due to depth restrictions, or flowing water. Hoop nets were set with the open end of the net facing downstream. The cod end of the net was tied to an anchor that was set upstream, using the flow of the water to keep the net deployed. This gear type is frequently used in efforts in the Mississippi watershed for the removal of Asian carps. Hoop nets were deployed overnight, from 16 to 48 hours. When possible, the nets were set for 48 hours. If bad weather or other circumstances precluded a 48 hour set, the nets were fished earlier.

TRAP NET SAMPLING

Trap nets, with a mesh size of 2.54 cm, a 1.2 m depth, 27.43 m long lead, and two wings 3 m long by 1.2 m deep were used to sample areas with low to no flow, and on a variety of substrate types. Trap nets were set in similar habitats as fyke nets, but the coarser mesh and larger net size targeted larger-bodied fishes. Trap nets required deeper water than fyke nets in order to deploy properly (minimum 1.2 m set depth). They were set with the lead attached to shore. The net was pulled taught and deployed perpendicular to the shoreline. A float was added to the net to provide access to the surface for any captured turtles. Trap nets were generally set for close to 24 hours and effort was recorded as the number of hours the net was deployed. Trap nets were introduced by the Burlington sampling crews, who had the vessel capacity in 2014 to set and fish the nets.

TRAWL SAMPLING

A 2.5 m Missouri trawl was used to sample fishes in areas where water clarity and depth minimized the effectiveness of other sampling gears such as fyke nets, tied-down gill nets, and trammel nets. Bottom trawling occurred primarily in Lake Huron and Lake Superior sites. The Missouri trawl was towed from the bow of the vessel in a downstream direction for approximately 100 m. The trawling speed was adjusted to ensure that the trawl did not dig into soft substrate, but stayed on bottom for proper collection of fishes. A small mesh size of 3.175 mm ace mesh was used to capture smaller bodied fishes.

FISH AND HABITAT DATA COLLECTION

Captured fishes were identified, measured, photographed, and returned to the water near the site of capture. Voucher specimens were preserved in 10% formalin for species requiring laboratory verification (based on DFO vouchering protocols). GPS coordinates and habitat data, including water and air temperature (°C), dissolved oxygen (mg/L), conductivity (µS/cm), pH, turbidity (NTU), wind speed (Km/h), water depth (m), sampling distance from shore, substrate percent composition (Wentworth Scale) and aquatic vegetation type and percent cover, were recorded for each site.

RESULTS

DFO's Asian carp early detection surveillance program collected a total of 43,928 fishes representing 92 species in 2014 (Tables 1, 2). The field program sampled a total of 745 sites in tributaries and wetlands in the Canadian waters of the Great Lakes basin (Table 2). A total of eight gear types were used during the sampling (Table 3). The mean number of fishes caught per waterbody was 1,220.22, with a mean number of fishes per site of 58.96 (Table 2). The maximum number of sites in a waterbody was in the Grand River where 125 sites were sampled, and the minimum number of sampling sites was 1, which occurred in Etobicoke Creek (Figure 36). The highest species richness was observed in the Grand River, where 55 species were detected, whereas the fewest species were captured in Lake Erie sites adjacent to Nanticoke Creek and Pelee Island where 3 species were detected (Table 4). The greatest number of fishes were caught in the Grand River at 10,948, and the fewest were caught in Kettle Creek where 79 fishes were detected (Table 4).

Boat electrofishing was the most used gear type, with 242 sampling sites conducted (32.5 % of sites; Figure 37). Seining was the least frequently deployed sampling technique, and was conducted at 18 sites (2.4 % of sites; Figure 37). Boat electrofishing captured the greatest number of species at 83 (89.25 % of all species detected; Figure 38), while the hoop nets detected the fewest species at 5, or 5.4 % of all species detected (Figure 38).

Habitat data were collected at all 745 sites (Marson et al. unpublished data); however, the results are outside the scope of this report.

BOAT ELECTROFISHER

Boat electrofishing was conducted at 242 sites in 28 waterbodies (Figure 37). A total of 173,682 seconds (48.25 hours) of shocking effort was conducted (Table 3), with an average of 717.7 seconds per site. The greatest amount of electrofishing effort was conducted in the Grand River, where 20,481 seconds of shocking effort was completed (Table 5). The lowest electrofishing effort occurred in the Goulais River and Ruscom River; 1,200 seconds of electrofishing effort were completed in each system (Table 5).

A total of 15,247 fishes representing 83 species were captured by boat electrofishing, including 70 Buffalo and 503 Common Carp (Table 3).

FYKE NET

Fyke nets were fished at 179 sites in 30 waterbodies (Figure 37). A total of 3,710.03 hours of set time was conducted, with an average set time of 20.73 hours per site. The greatest numbers of sites were set in the Grand River, where 26 sets were completed for a total of 519.46 hours, and the fewest sets (2), were completed in the Humber River and Kettle Creek, with 47.19 hours of set time and 36.56 hours of set time, respectively (Table 5).

A total of 15,732 fishes representing 67 species were captured in fyke nets, including 5 Buffalo and 31 Common Carp (Table 3).

SEINE NET

Seine net sampling occurred at 18 sites in 9 waterbodies (Figure 37). A total of 34 hauls were performed, with an average of 1.89 hauls per site. The greatest number of sites occurred in the Goulais River, where 4 sites with 1 haul at each were completed (Table 6). The highest number of hauls occurred in the Maitland River, where 9 hauls were performed over 3 sites (Table 6).

A total of 4,353 fishes representing 42 species were captured in seine nets (Table 3). No Buffalo or Common Carp were captured by seine net.

TIED-DOWN GILL NET

Tied-down gill nets were used to sample 57 sites in 14 waterbodies (Figure 37). A total of 1,716 minutes of set time, and 10,424.16 m of net were set. The greatest number of sites occurred in the Detroit River, where 9 sites were set for a total of 229 minutes, and 1,645.92 m of net (Table 5). A single site was sampled by tied-down gill net in the Canard River, for a total of 46 minutes and 182.88 m of net (Table 5).

A total of 715 fishes representing 11 species were captured in tied-down gill nets, including 107 Buffalo and 514 Common Carp (Table 3).

TRAMMEL NETS

Trammel nets were used to sample 89 sites in 21 waterbodies (Figure 37). A total of 3,300 minutes of set time and 16,276.32 m of net were set. The greatest number of sites occurred in the Grand River, where 21 sites were set for a total of 1,096 minutes, and 3840.48 m of net (Table 5). Single sites were sampled in a number of rivers where there was limited habitat for effectively deploying a trammel net. Six waterbodies had a single net set (Table 5).

A total of 581 fishes representing 16 species were captured by trammel net sampling, including 119 Buffalo and 295 Common Carp (Table 3). The only Asian carp detected in 2014, a Grass Carp, was captured in a trammel net (Table 3).

TRAP NETS

Trap nets were used to sample 98 sites in 20 waterbodies (Figure 37). A total of 2,076.63 hours of set time were completed. The greatest number of sets occurred in the Grand River, where 22 sites were set for a total of 461.25 hours (Table 6). Single sites were sampled in five waterbodies where suitable habitat limited the ability to set nets (Table 6).

A total of 4,535 fishes representing 39 species were captured by trap nets, including 41 Buffalo and 429 Common Carp (Table 3).

TRAWL

A trawl net was used to sample 40 sites in 8 waterbodies (Figure 37). A total of 40 hauls were conducted. The highest effort was 10 sites on the Kaministiqua River, where 10 hauls were completed (Table 6). The fewest sites were performed on Hog Creek and the Nottawasaga River, where 2 hauls were performed at each (Table 6). Trawling was conducted by the Sault Ste. Marie crews.

A total of 2,592 fishes representing 26 species were captured by trawling (Table 3). No Buffalo or Common Carp were captured in the trawl.

HOOP NETS

Hoop nets were used to sample 22 sites in 5 waterbodies (Figure 37). A total of 544.37 hours of set time were completed. The highest effort occurred on the Grand River, where 12 sites were sampled, for a total of 241.51 hours of set time (Table 6). Single sites were set in Big Otter Creek and Jeanette's Creek, for a total of 20.1 hours and 48.38 hours, respectively (Table 6).

A total of 172 fishes representing 5 species were captured by hoop net sampling, including 4 Buffalo and two Common Carp (Table 3).

SURROGATE SPECIES

All of the sucker species of the genus *Ictiobus* (buffaloes) were considered as surrogate species for Bighead and Silver carps in the 2014 early detection surveillance program. A total of 347 *Ictiobus* species were captured during the 2014 sampling (Tables 3 and 4). The greatest number were captured in the Grand River, where 71 *Ictiobus* spp. were captured (Table 4).

The trammel net caught the most *Ictiobus* spp., with 119 (34 %), followed by tied-down gill nets with 108 (31 %) individuals captured (Figure 40). *Ictiobus* spp. was captured by six of the eight gear types used. *Ictiobus* spp. was not collected in seine or trawl samples.

Common Carp were also used as a surrogate, primarily for Grass Carp. The detection of Common Carp illustrated that the sampling was successfully detecting large-bodied, highly mobile fishes. A total of 1,774 Common Carp were captured during the 2014 sampling. The greatest number was captured in Cedar Creek, where 592 Common Carp were captured (Table 4). Common Carp were detected in 28 waterbodies.

Tied-down gill nets caught the most Common Carp, with 514 (29 %) of the specimens captured (Figure 41). Common Carp was not captured in seine net or trawl samples.

ASIAN CARPS

During the 2014 early detection surveillance program, DFO's Asian Carp Program captured one Grass Carp in a trammel net. This specimen was captured on September 23, 2014 in the Grand River in Dunnville, Ontario. The fish had a total length of 985 cm, a weight of 13.93 kg and was triploid (sterile). The Grass Carp was captured at a depth of 2.4 m, in a site that was mostly free of vegetation (90% of the site), but had some floating and emergent vegetation nearshore. The substrate was soft, a combination of silt (80%), and clay (20%). Water velocity at the site was 0.05 m/second. A combination of pounding (noise that drives fish towards the set block net) and boat electrofishing inside the blocked off area was used to push fishes into the net. A total of 15 minutes of boat shocking was conducted inside and around the net to try and increase the likelihood of pushing large-bodied fishes into the net.

Following the capture of the Grass Carp; the surveillance program field crews and remaining Asian Carp Program staff immediately initiated response protocols involving intensive targeted sampling to ensure no further Grass Carp were in the area. Intensive targeted sampling means that non-target fishes are not processed (identified/measured) as they are during regular surveillance sampling. After intensive sampling using both trammel nets and electrofishing with two vessels for two days, no additional individuals were observed.

SUMMARY

In 2014, the second field season for the Asian carp early detection surveillance program, a total of 36 early detection areas were sampled, including an additional 12 from the 2013 surveillance program (Marson et al. 2014). Seven hundred and forty five sites were sampled using eight gear types to target both large and small fishes, and a range of habitat types. A total of 43928 fishes were captured, representing 92 species. Surrogate species were captured in six of the eight gear types. A total of 347 *Ictiobus* spp. were captured in 12 waterbodies, including tributaries to Lake Huron, Lake St. Clair, Lake Erie, and Lake Ontario. Common Carp were captured in 28 waterbodies, and were detected in tributaries to each of the Great Lakes and interconnecting channels sampled in 2014. The ability to detect 347 *Ictiobus* spp. and 1774 Common Carp, surrogate species for Asian carps, in 28 of the 36 sites sampled suggests that the gears and techniques used by the surveillance program are an effective means for detecting

Asian carps. Furthermore, the capture of the only Grass Carp detected in Canadian waters in 2014 highlights the effectiveness of the gear, and that the appropriate habitat is being targeted.

Building on the success of the initial early detection surveillance program in 2013, the 2014 sampling increased the number of sites sampled and introduced new sampling techniques into the program. Trap nets were added to the program in order to increase the catch of large-bodied fishes moving through nearshore habitats in the evening. The nets are deployed overnight, cover a larger area, and can be set in deeper water than fyke nets while still fishing the full water column. In addition, the larger mesh size allows for the capture of larger-bodied fishes than the smaller mesh fyke nets. The coarser mesh also allows smaller bodied fishes to escape the net, thereby selectively sampling larger-bodied fishes.

Hoop nets were deployed in order to sample in deep flowing water where the program was unable to effectively sample in 2013. There are only a few waterbodies where hoop nets were needed to sample deep flowing water (the mid-channel areas of Big Otter Creek, Detroit River, Grand River, Jeanette's Creek, and the Thames River). Although hoop nets were successful in capturing a few species, their use was limited, and they were found to be very cumbersome to deploy. Hoop nets will be used in 2015, however, their use will continue to be limited to areas where other gears are not suitable. The increased water clarity and limited habitat for fishing tied-down gill nets and trammel nets in northern waterbodies led to the inclusion of trawling in the sampling gears. Trawling was used to supplement boat electrofishing, fyke net sampling, and seining in the more northern surveillance sites.

The sampling effort across different gears was not equal throughout the waterbodies sampled. This is due to the variety of habitat types encountered throughout the sampling sites. Certain gear types require particular habitat characteristics in order to be properly deployed. For example, seining requires wadeable habitat, free of snags, in zero to medium flow. As a result, seining was not conducted at many of the waterbodies targeted by the Asian carp early detection surveillance program.

Additional sampling and scouting occurred in 2014 as a result of increased sampling efficiency through a combination of the crews' increased familiarity with the gear types, knowledge of existing early detection surveillance locations, as well as an additional sampling crew working from the Burlington office. Additional early detection surveillance sites were scouted in Lake Superior (Goulais River and Kaministiqua River), Lake Huron (Magnetawan River, Naiscoot River, and Shebeshekong River), the Huron-Erie corridor (Big Creek), Lake Erie (Henry Lake on Pelee Island), and in Lake Ontario (Credit River, Etobicoke Creek, Humber River, and Jordan Harbour). Not all of the scouted sites sampled will continue to be sampled by the early detection surveillance program. For example, both Henry Lake on Pelee Island and Etobicoke Creek will not be sampled in 2015. The sites in Henry Lake were separated from Lake Erie by a large barrier beach, and are not accessible by boat. These sites are at a low risk of being accessed by Asian carps. In addition, no Buffalo species were captured in Henry Lake. Etobicoke Creek was found to have limited suitable habitat for Asian carps. No Asian carp surrogates were captured in Etobicoke Creek.

Of particular interest in the 2014 Asian carp surveillance sampling was the capture of a Grass Carp in the Grand River. The fish was captured in the channel on the west side of the river downstream of the Highway 3 bridge crossing in Dunnville, Ontario. This was the third Grass Carp captured in that location. The previous captures occurred in the spring (angled fish) and fall (trammel net) of 2013. Two of the Grass Carp were captured in trammel nets during DFO Asian carp surveillance sampling, and one was angled. The Grass Carp were located in an area with low flow, water depth less than 3 m deep, and some nearshore emergent and floating vegetation, primarily White Water Lily (*Nyphaea odorata*). The location is adjacent to deeper

water below the bridge (approximately 5 m), and is near one of the few areas in the side channel of the Grand River where there is aquatic vegetation. This area will be targeted in future Asian carp early detection surveillance sampling.

The addition of hoop nets and 4' trap nets improved the sampling versatility of the Asian carp surveillance program in 2014. Trap nets increased the catch of large-bodied species in shallow vegetated and non-vegetated nearshore habitats, and many surrogate species were detected. While the average catch in hoop nets was much lower than trap nets, the hoop nets were able to detect fishes in deep flowing waters that were not accessible with other gear types. Both gear types will be carried forward into the 2015 sampling season. In addition to the 6' hoop nets, a 3' version of the net will be deployed in 2015. The smaller version will be less cumbersome to deploy, and will provide an opportunity to assess the difference in the catch rates between the two sizes of nets. Boat electrofishing efforts will continue to be standardized to 600 seconds per site. In 2014, the catches were of sufficient size in 600 seconds that the live-well in the boat was often near capacity.

In 2015 the surveillance program will continue scouting early detection sites in Lake Ontario, and continue surveillance sampling on the early detection sites selected in Lake Superior, Lake Huron, the Huron-Erie corridor, Lake Erie, and Lake Ontario.

ACKGNOWLEDGMENTS

We thank the 2014 summer and fall field staff for the Asian Carp Program, including: D'Arcy Campbell, Bradley Doyle, Colin Illes, Danielle Hosick, Edyta Ratajczyk, Jordan Boudreau, Justin Barbati, Katarina Doughty, Meaghan Kindree, Michael Clark, Michael Gioseffi, Natalie Rook, Nichole Wiemann, and Sydonie Epifani. This project was funded through the DFO Asian Carp Program.

REFERENCES

Asian Carp Regional Coordinating Committee (ACRCC) Monitoring and Response Workgroup. 2014. Monitoring and Response Plan for Asian Carp in the Upper Illinois River and Chicago Area Waterway System. http://www.asiancarp.us/documents/MRP2014.pdf (accessed 6 October, 2014).

Cudmore, B. Mandrak, N.E., Dettmers, J., Chapman, D.C., and Kolar, C.S. 2012. Binational Ecological Risk Assessment of Bigheaded Carps (*Hypophthalmichthys spp.*) for the Great Lakes Basin. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/114. Vi+57 p.

Holm, E., N.E. Mandrak and M.E. Burridge 2010. ROM field guide to freshwater fishes of Ontario. Royal Ontario Museum, 464pp.

Lodge, D.M., Williams, S.L., MacIsaac, H., Hayes, K., Leung, B., Reichard, S., Mack, R.N., Moyle, P.B., Smith, M., Andow, D.A., Carlton, J.T., and McMichael, A. 2006. Biological Invasions: recommendations for U.S. policy and management. Ecol. Appl. 16: 2035-2054.

Marson, D., Gertzen, E., Cudmore, B. 2014. Results of the Burlington 2013 Asian carp early detection field surveillance program. Can. Manuscr. Rep. Fish. Aquat. Sci. 3054: vii + 27 p.

Nelson, J.S., Crossman, E.J., Espinosa-Pérez, H., Findley, L.T., Gilbert, C.R., Lea, R.N., and Williams, J.D. 2003. The "Names of Fishes" list, including recommended changes in fish names: Chinook Salmon for Chinook Salmon, and *Sander* to replace *Stizostedion* for the Sauger and Walleye. Fisheries 28: 38-39.

Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston: Houghton Mifflin Harcourt, 663pp.

Vander Zanden, M.J., Hansen, G.J.A., Higgins, S.N., and Kornis, M.S. 2010. A pound of prevention, plus a pound of cure: early detection and eradication of invasive species in the Laurentian Great Lakes. J. Great Lakes Res. 36: 199-205.

FIGURES

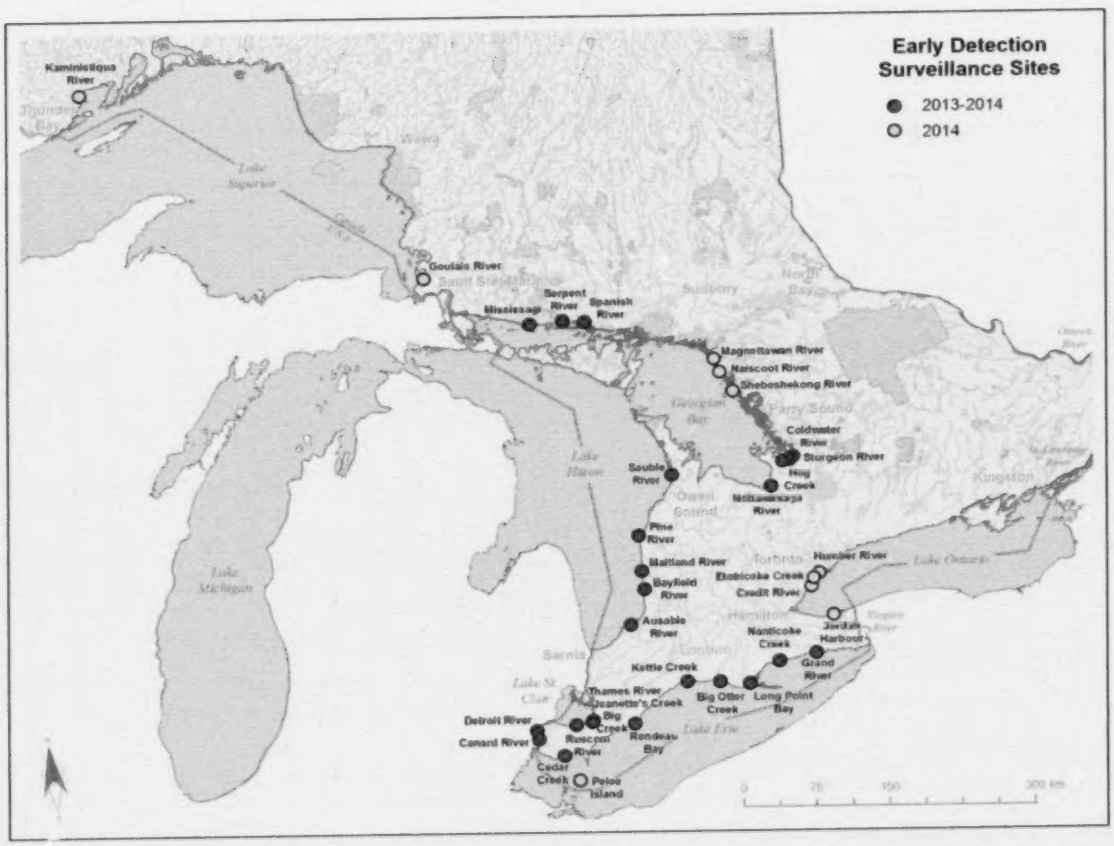

Figure 1. 2014 Asian Carp Program early detection surveillance sites on the Canadian side of the Great Lakes.

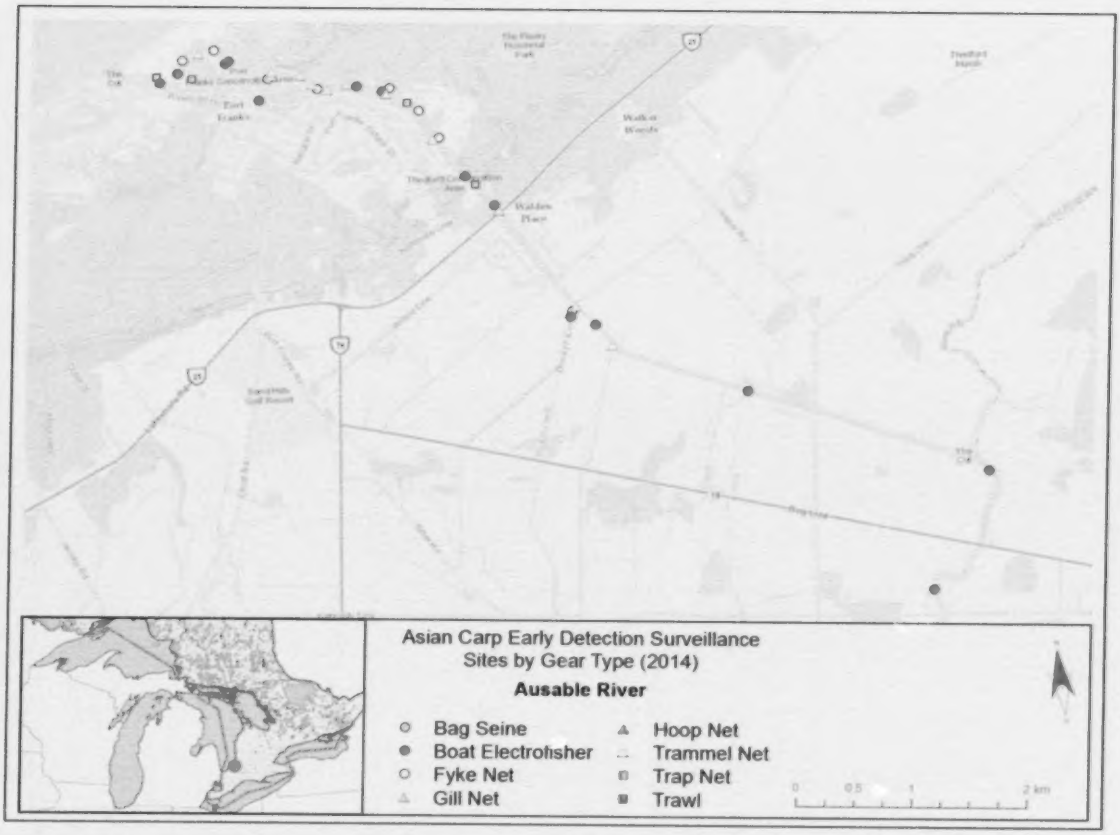

Figure 2. Asian Carp Program early detection surveillance sites, and gear types used, in the Ausable River in 2014.

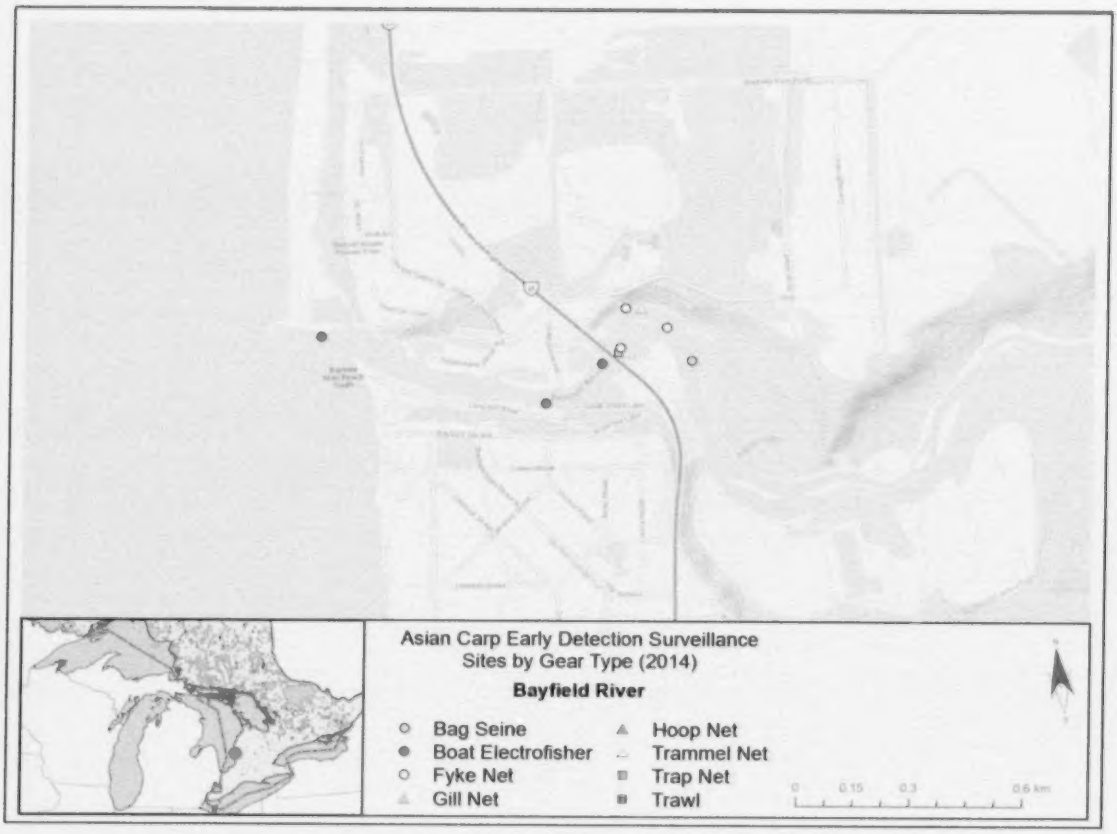

Figure 3. Asian Carp Program early detection surveillance sites, and gear types used, in the Bayfield River in 2014.

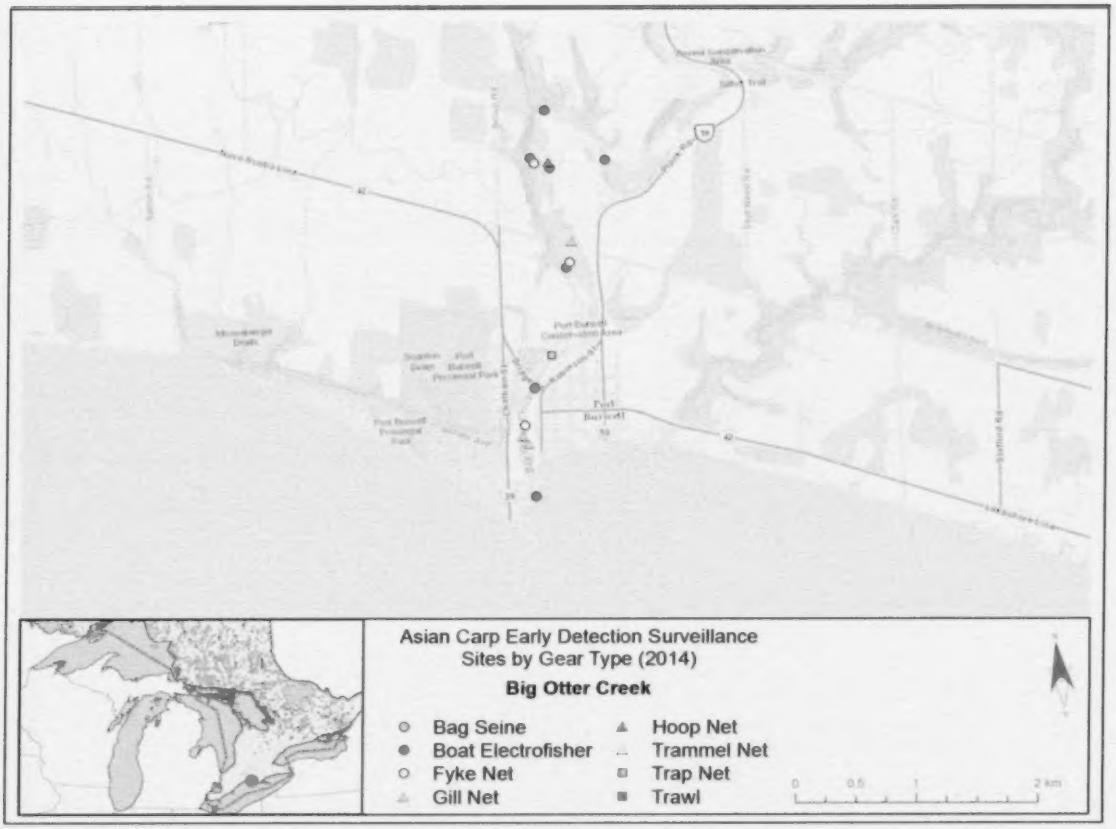

Figure 4. Asian Carp Program early detection surveillance sites, and gear types used, in Big Otter Creek in 2014.

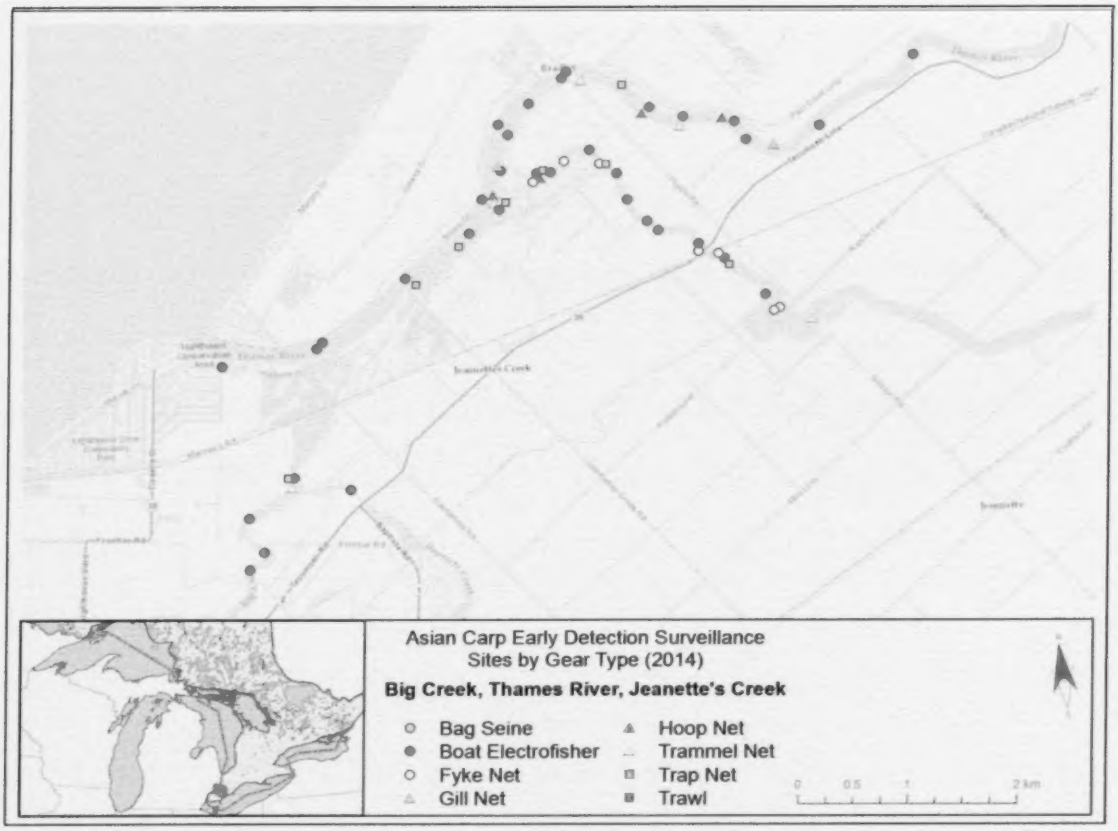

Figure 5. Asian Carp Program early detection surveillance sites, and gear types used, in Big Creek, Thames River and Jeanette's Creek in 2014.

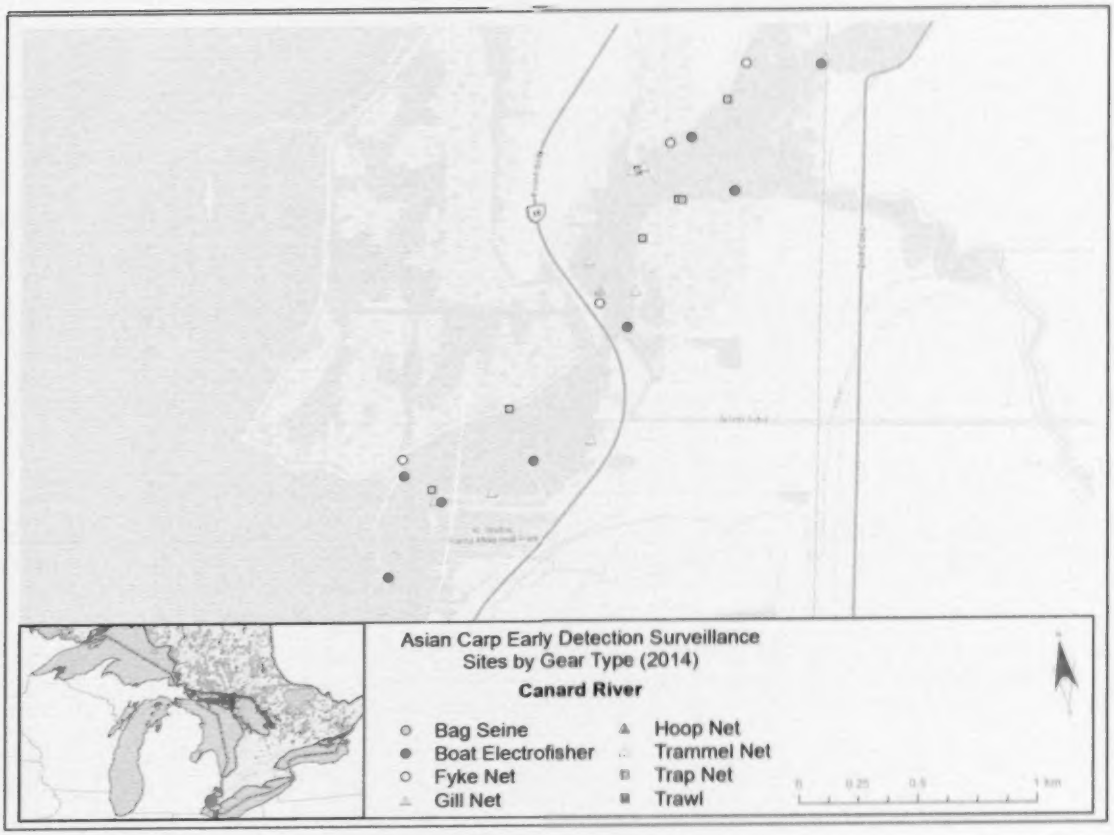

Figure 6. Asian Carp Program early detection surveillance sites, and gear types used, in the Canard River in 2014.

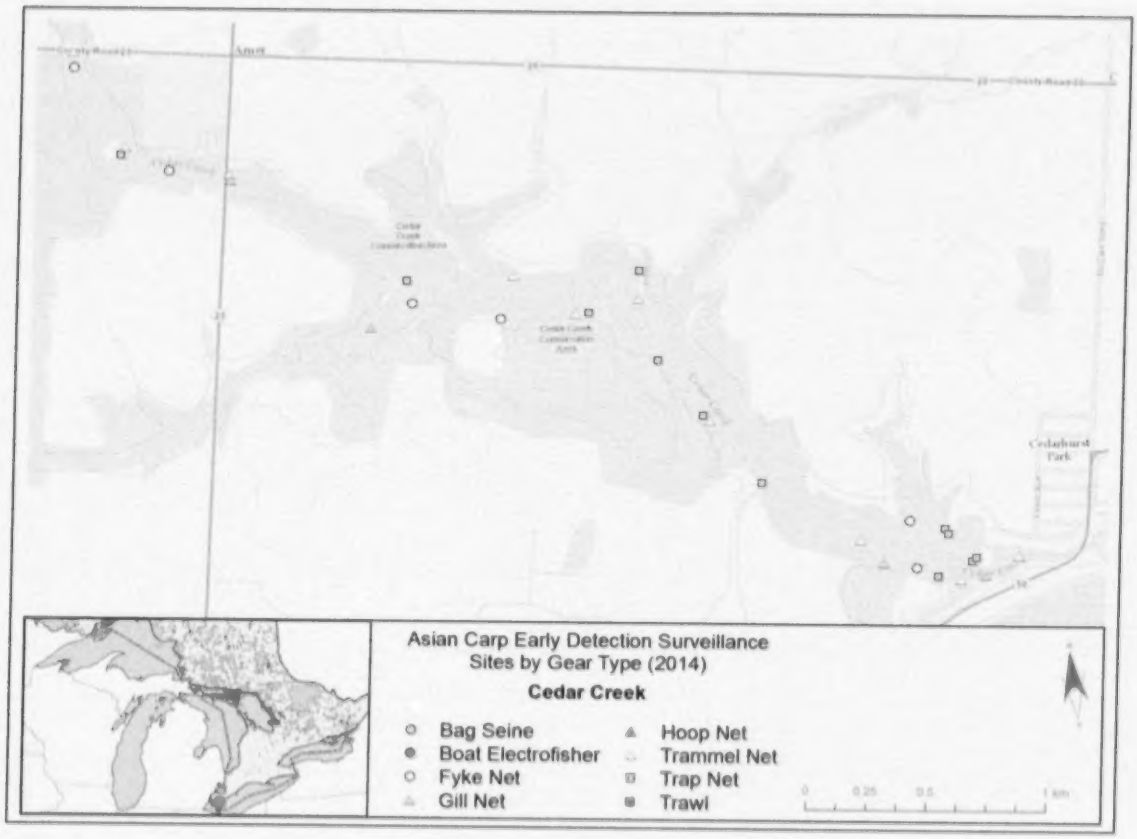

Figure 7. Asian Carp Program early detection surveillance sites, and gear types used, in Cedar Creek in 2014.

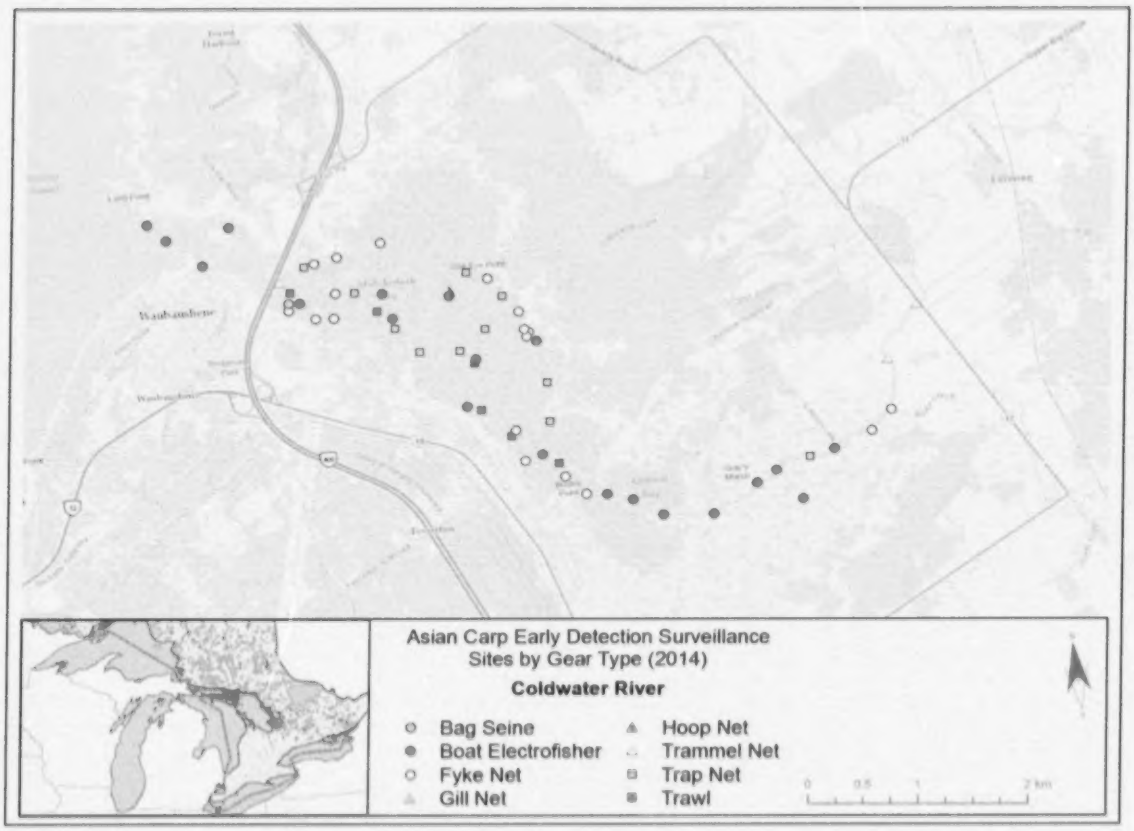

Figure 8. Asian Carp Program early detection surveillance sites, and gear types used, in the Coldwater River in 2014.

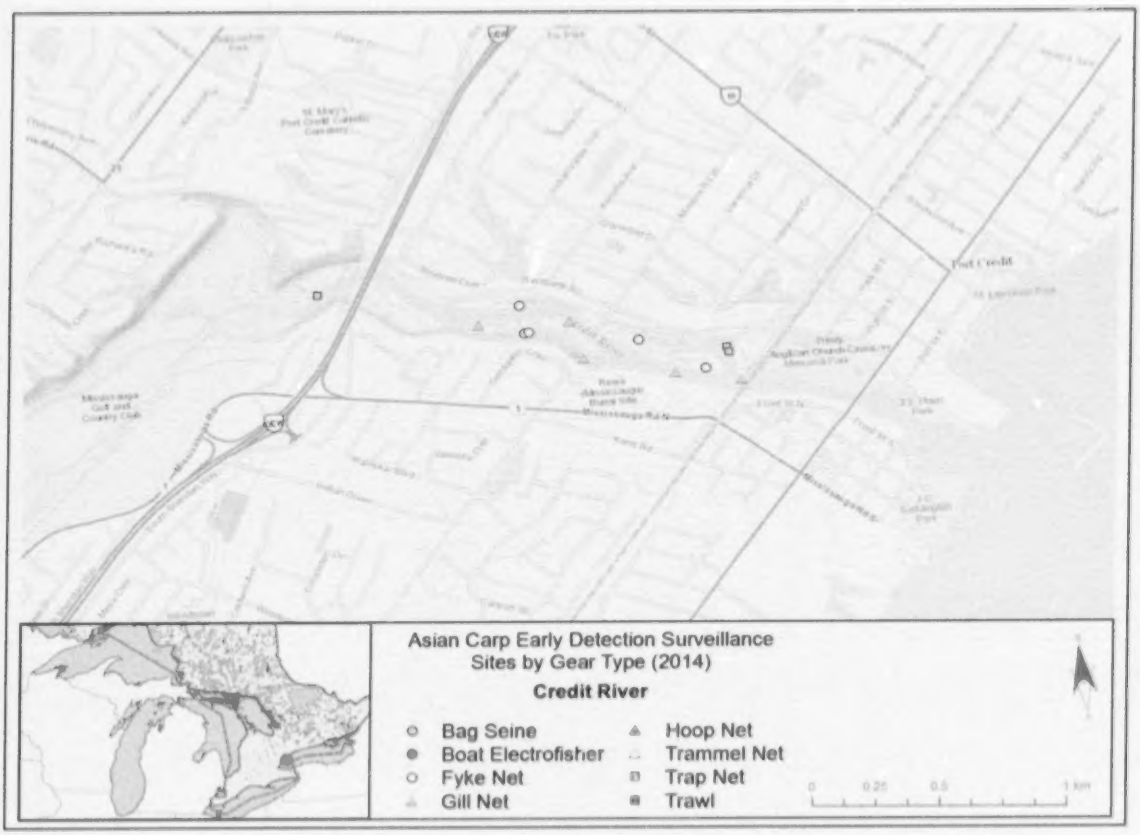

Figure 9. Asian Carp Program early detection surveillance sites, and gear types used, in the Credit River in 2014.

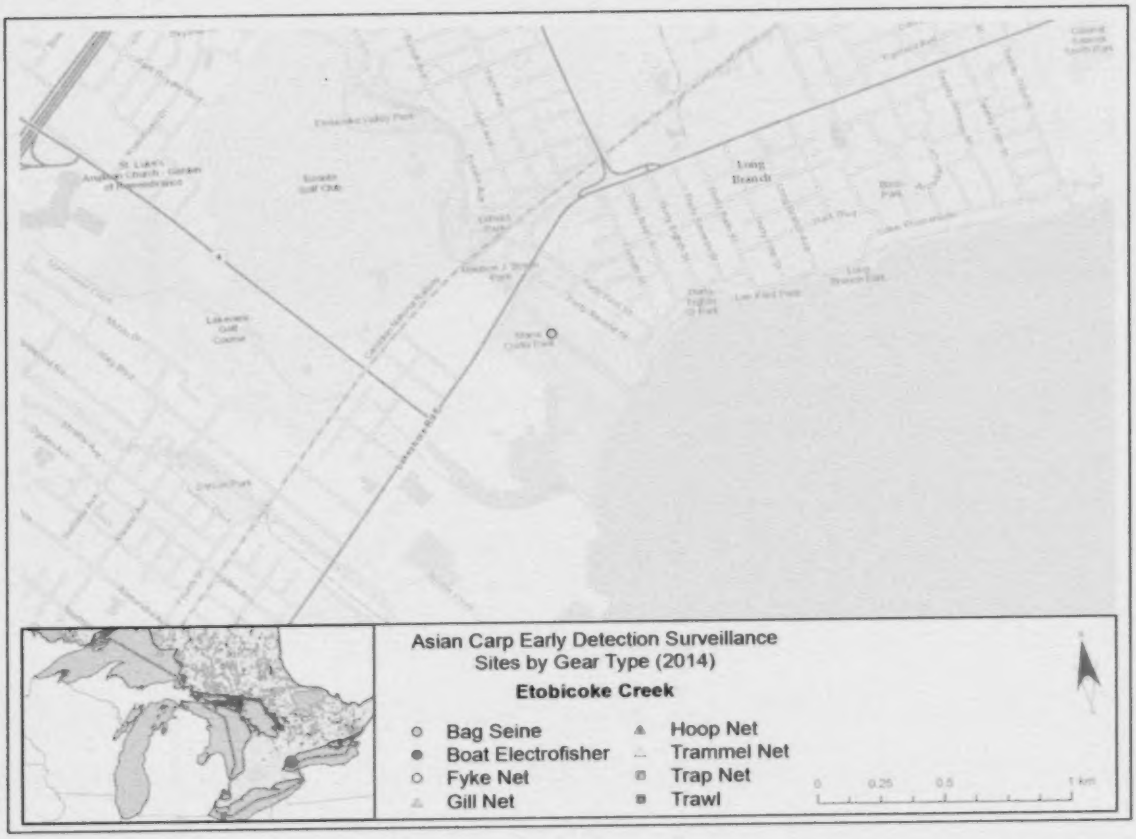

Figure 10. Asian Carp Program early detection surveillance sites, and gear types used, in Etobicoke Creek in 2014.

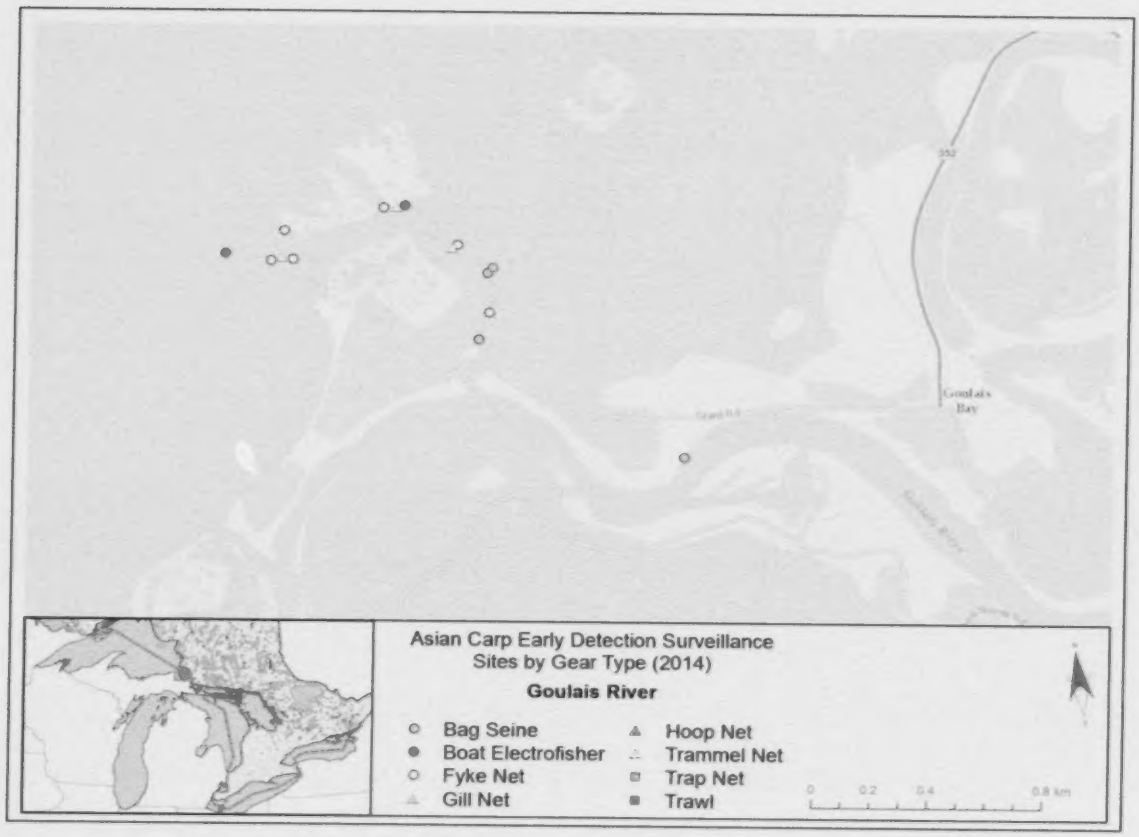

Figure 11. Asian Carp Program early detection surveillance sites, and gear types used, in the Goulais River in 2014.

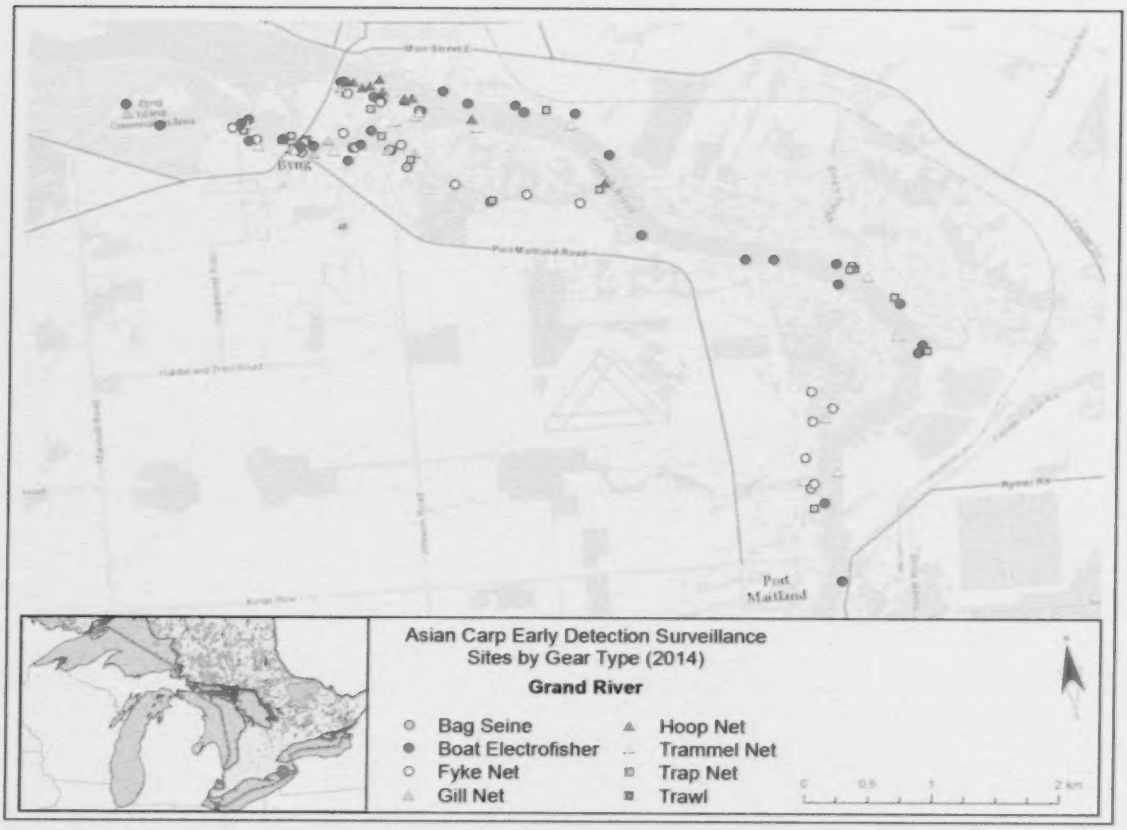

Figure 12. Asian Carp Program early detection surveillance sites, and gear types used, in the Grand River in 2014.

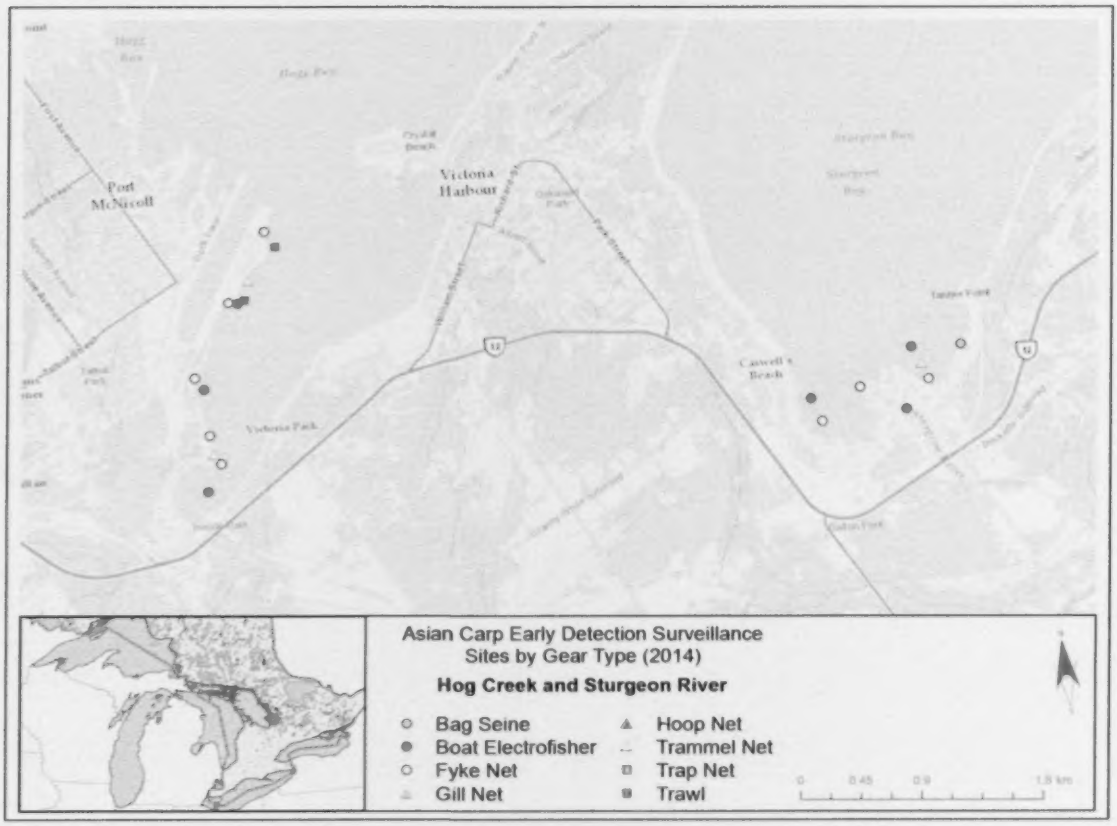

Figure 13. Asian Carp Program early detection surveillance sites, and gear types used, in Hog Creek and Sturgeon River in 2014.

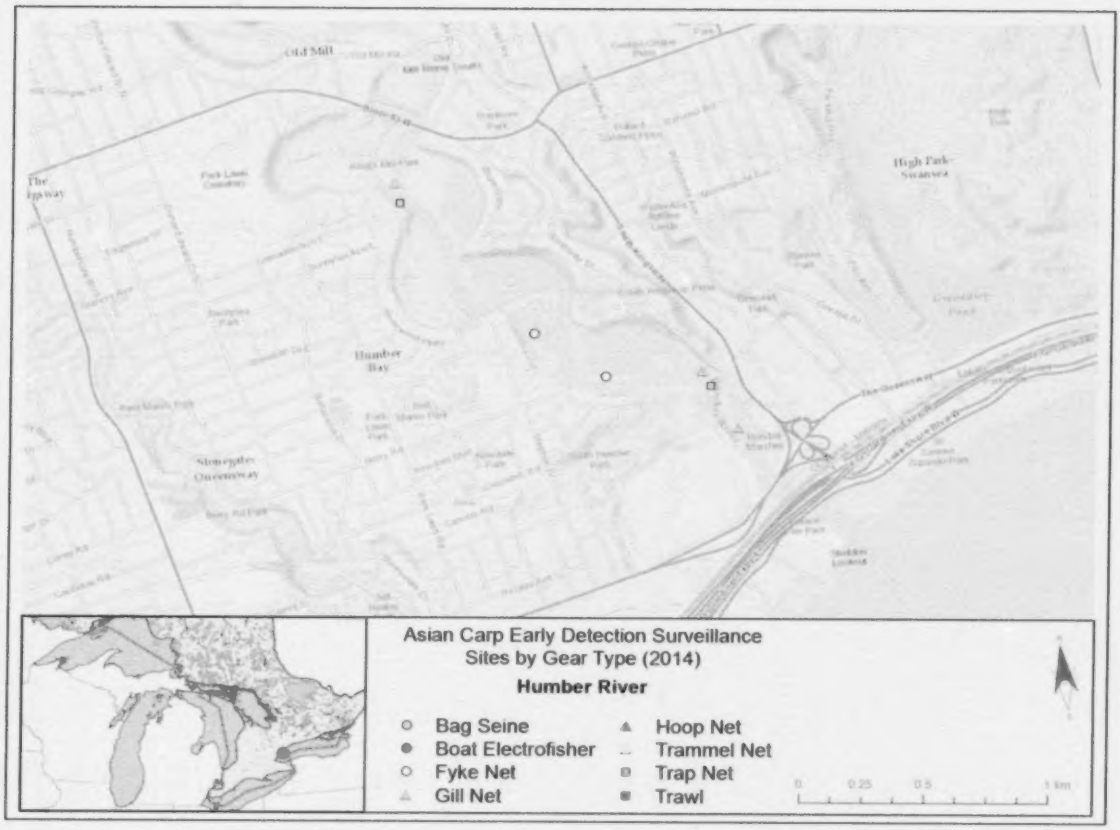

Figure 14. Asian Carp Program early detection surveillance sites, and gear types used, in the Humber River in 2014.

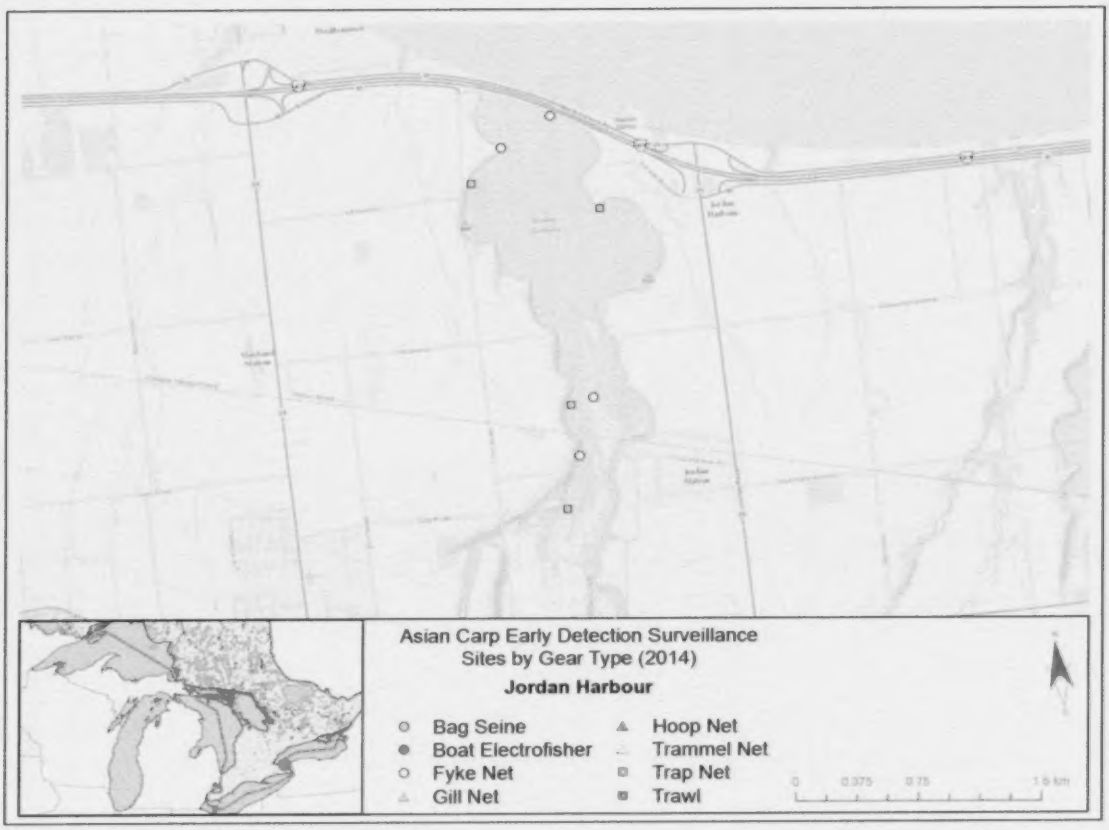

Figure 15. Asian Carp Program early detection surveillance sites, and gear types used, in Jordan Harbour in 2014.

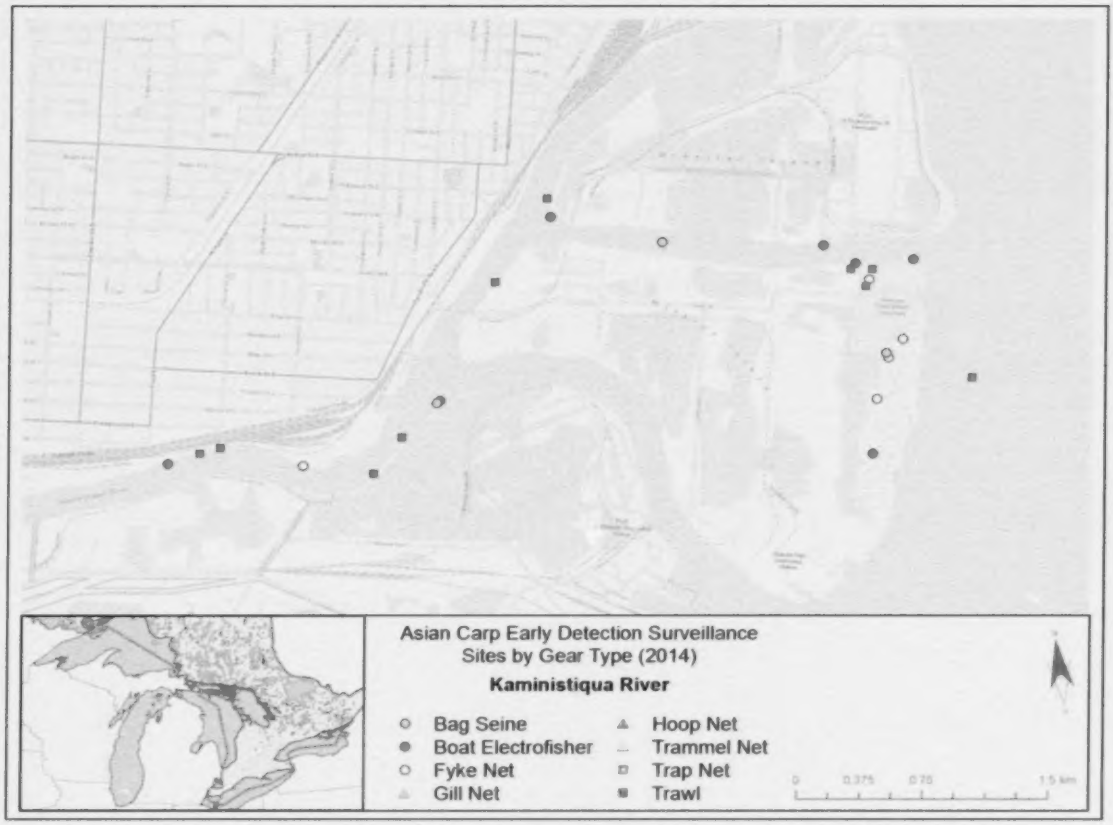

Figure 16. Asian Carp Program early detection surveillance sites, and gear types used, in the Kaministiqua River in 2014.

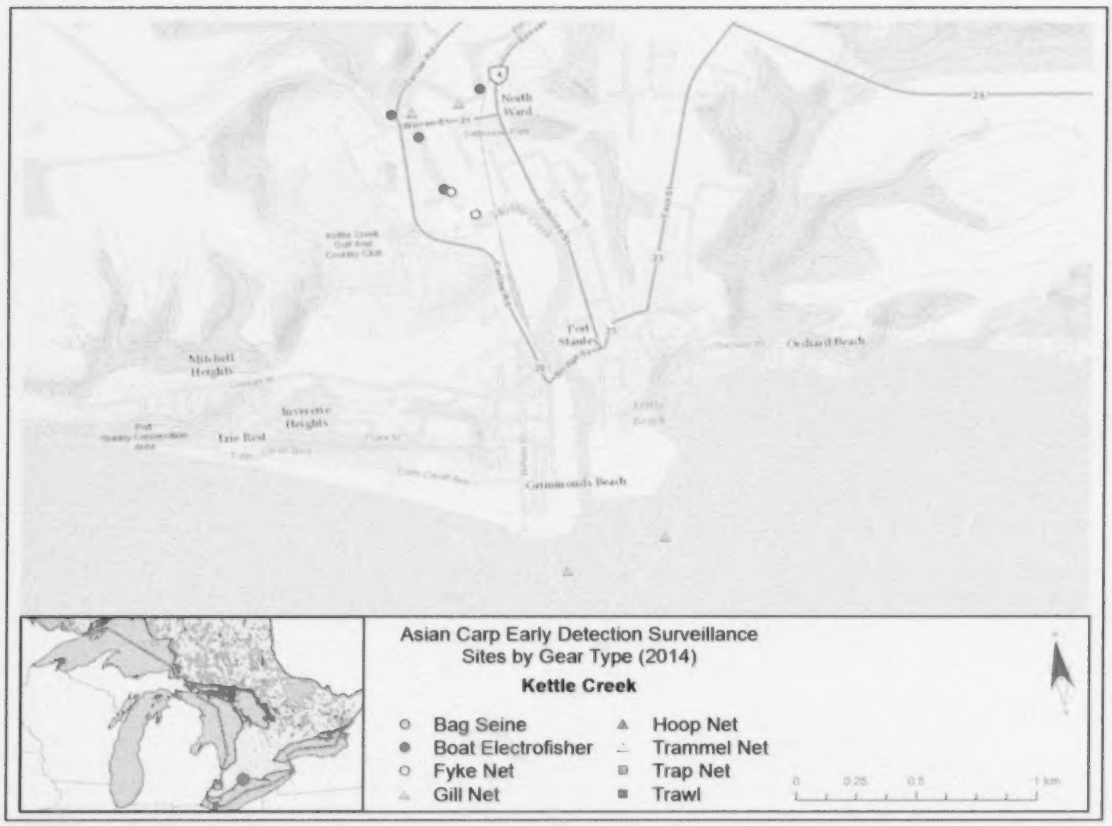

Figure 17. Asian Carp Program early detection surveillance sites, and gear types used, in Kettle Creek in 2014.

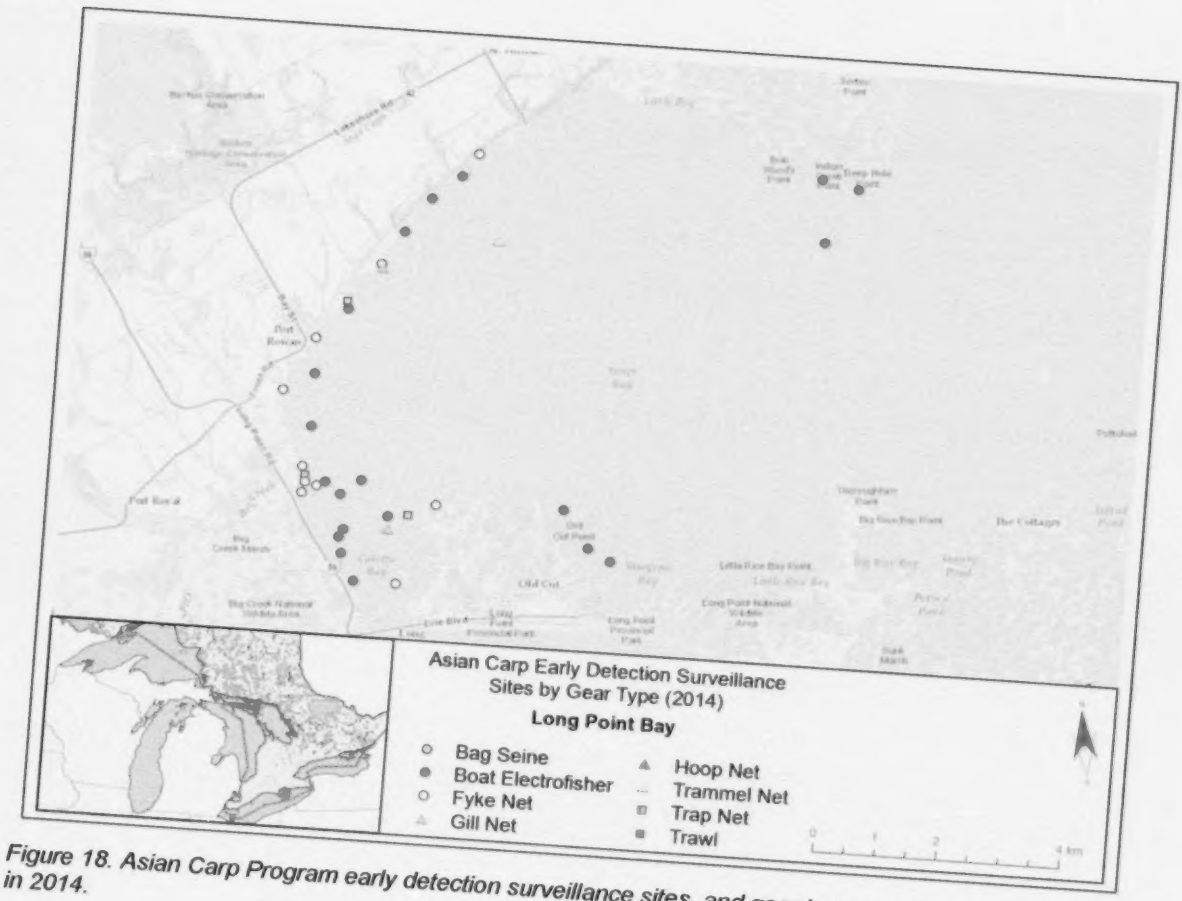

Figure 18. Asian Carp Program early detection surveillance sites, and gear types used, in Long Point Bay in 2014.

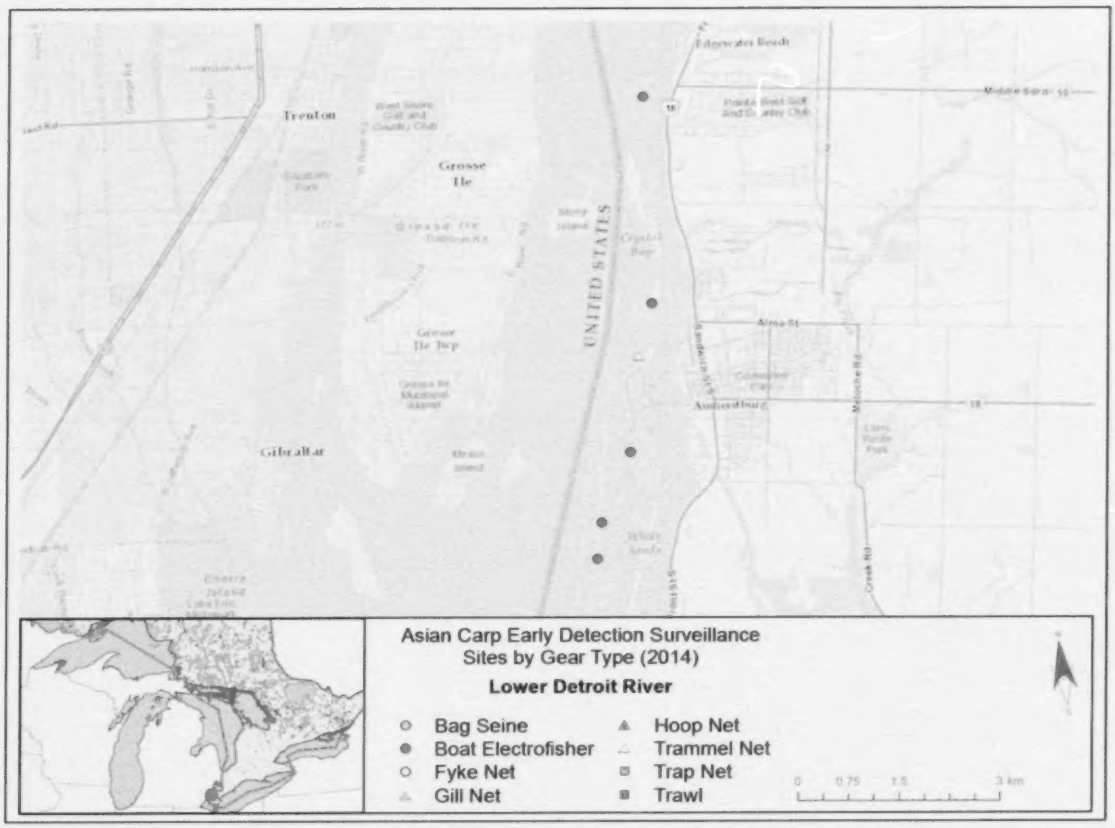

Figure 19. Asian Carp Program early detection surveillance sites, and gear types used, in the Lower Detroit River in 2014.

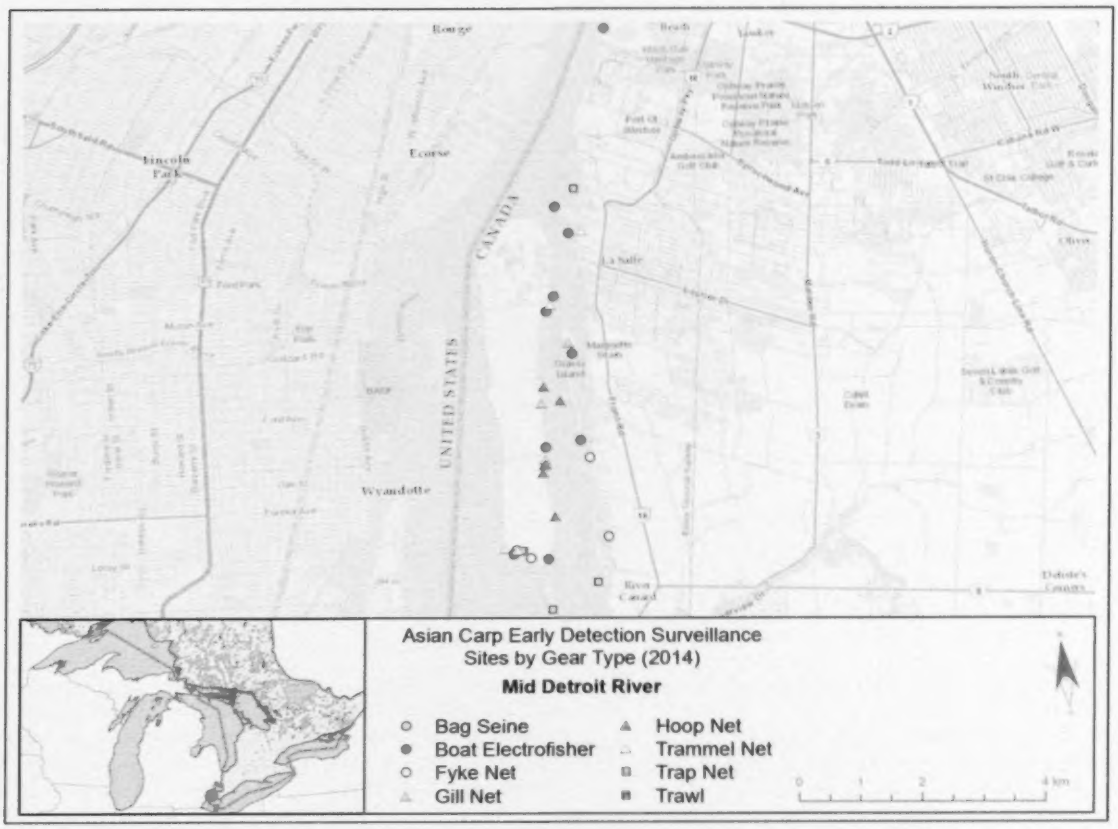

Figure 20. Asian Carp Program early detection surveillance sites, and gear types used, in the Detroit River (Mid) in 2014.

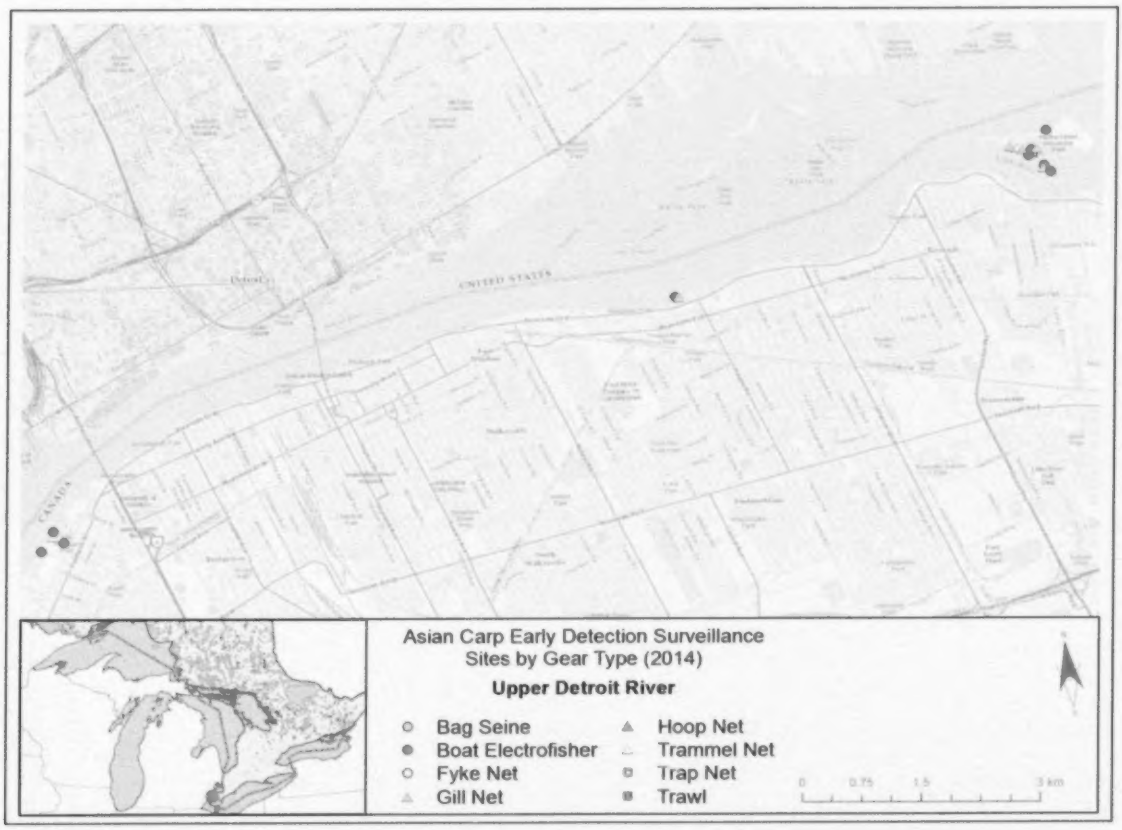

Figure 21. Asian Carp Program early detection surveillance sites, and gear types used, in the Detroit River (Upper) in 2014.

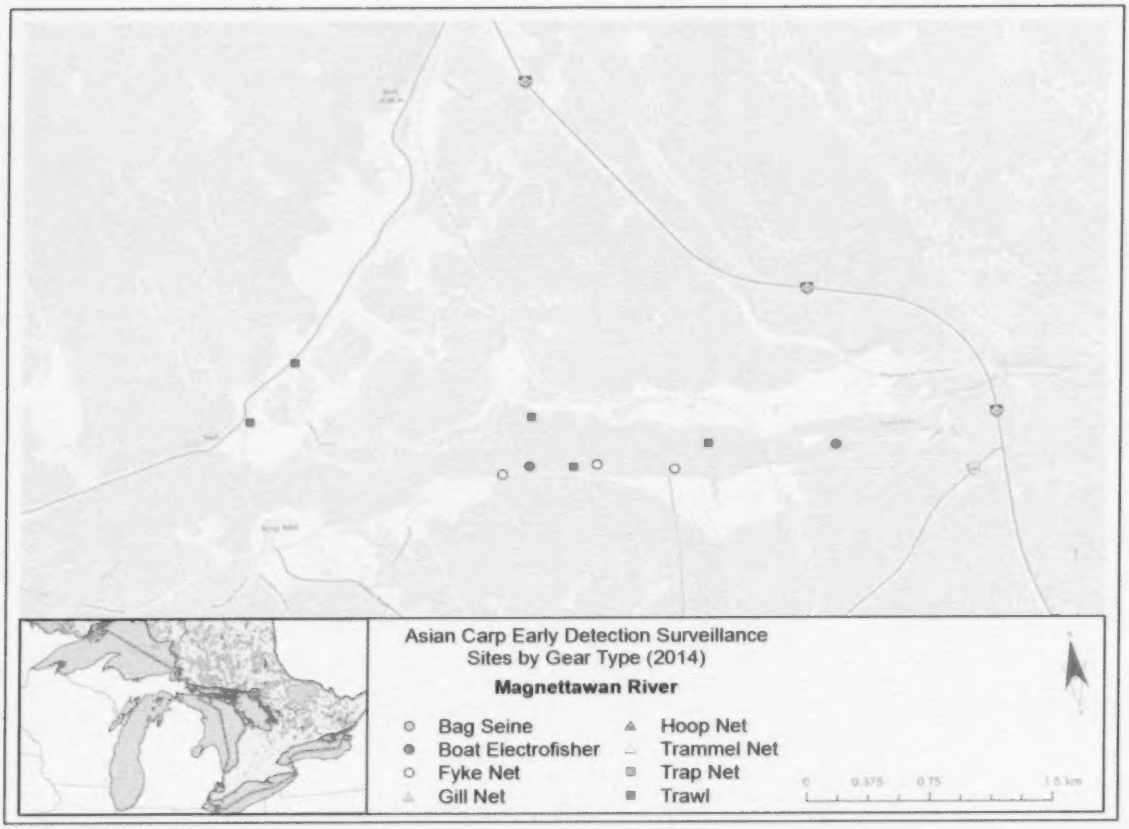

Figure 22. Asian Carp Program early detection surveillance sites, and gear types used,in the Magnettawan River in 2014.

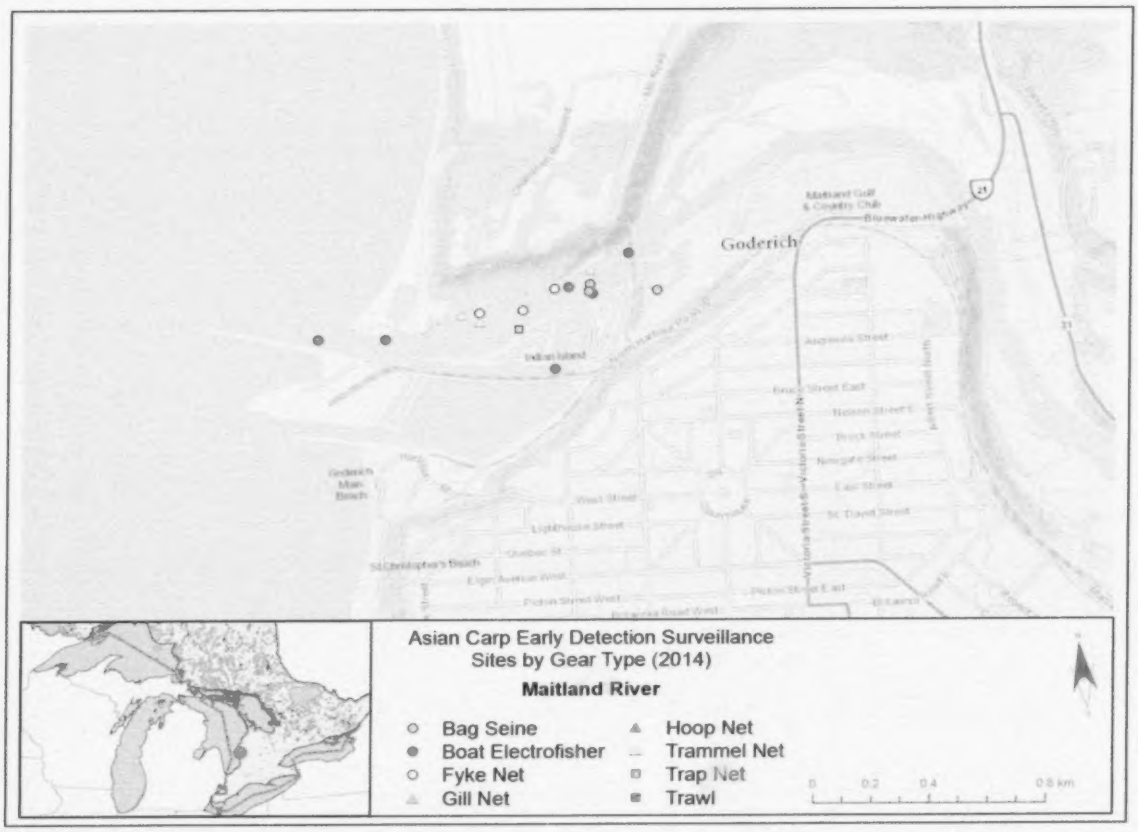

Figure 23. Asian Carp Program early detection surveillance sites, and gear types used, in the Maitland River in 2014.

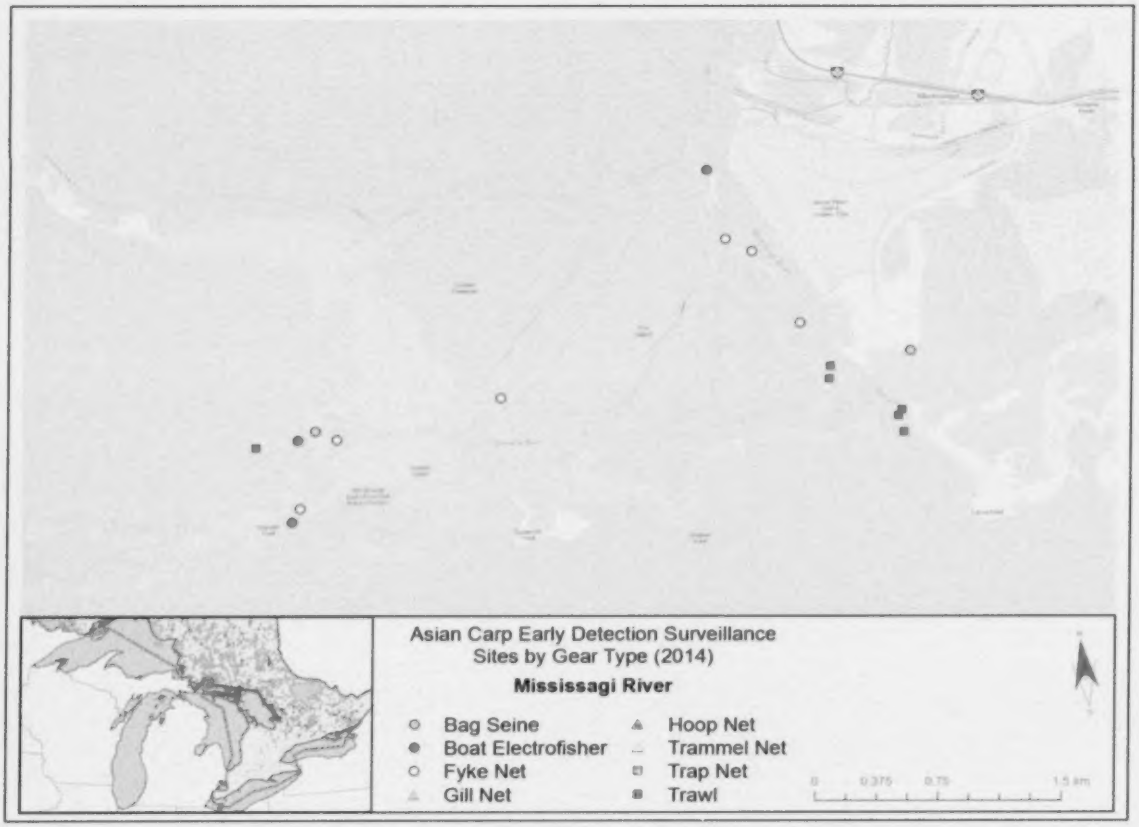

Figure 24. Asian Carp Program early detection surveillance sites, and gear types used, in the Mississagi River in 2014.

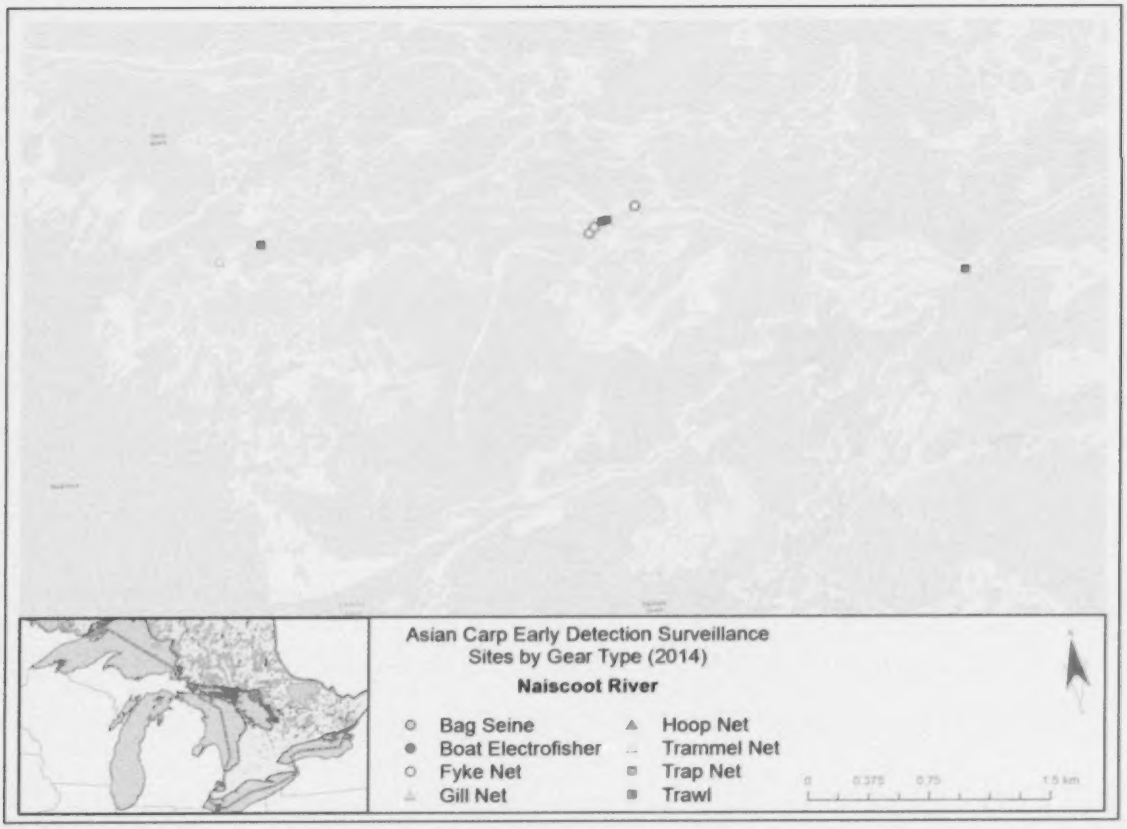

Figure 25. Asian Carp Program early detection surveillance sites, and gear types used, in the Naiscoot River in 2014.

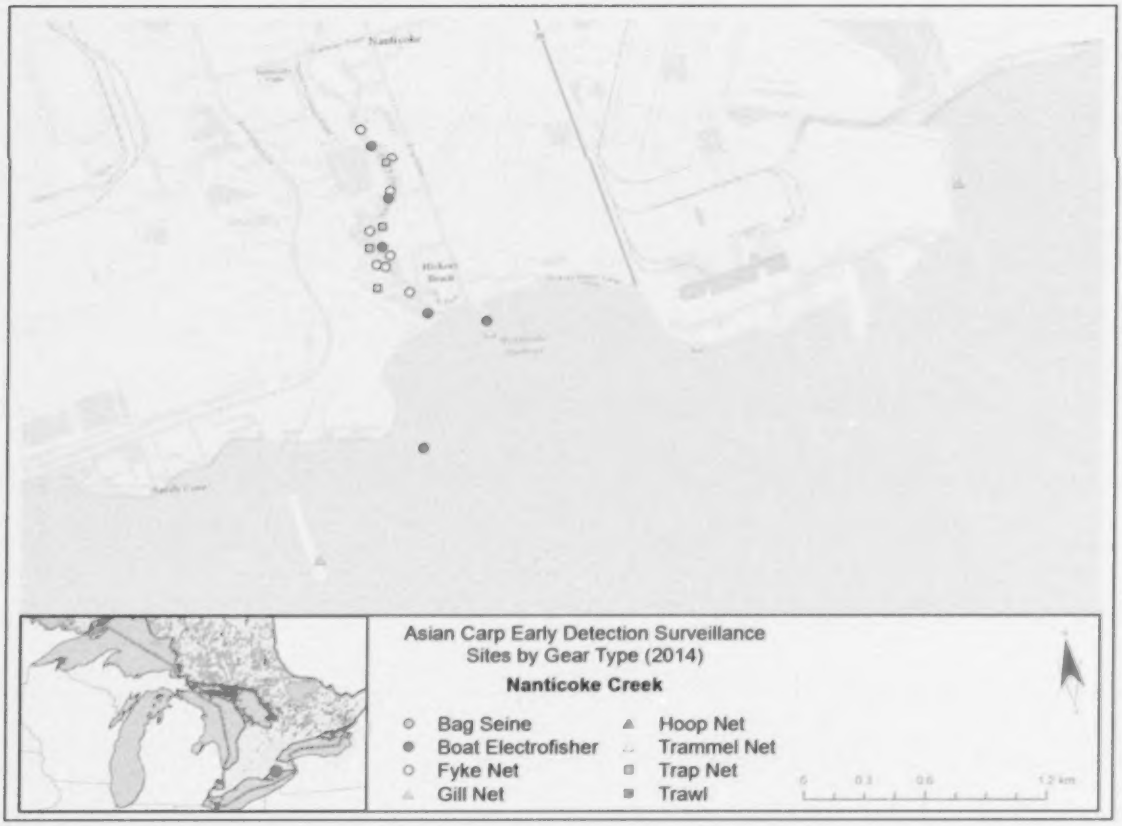

Figure 26. Asian Carp Program early detection surveillance sites, and gear types used, in Nanticoke Creek in 2014.

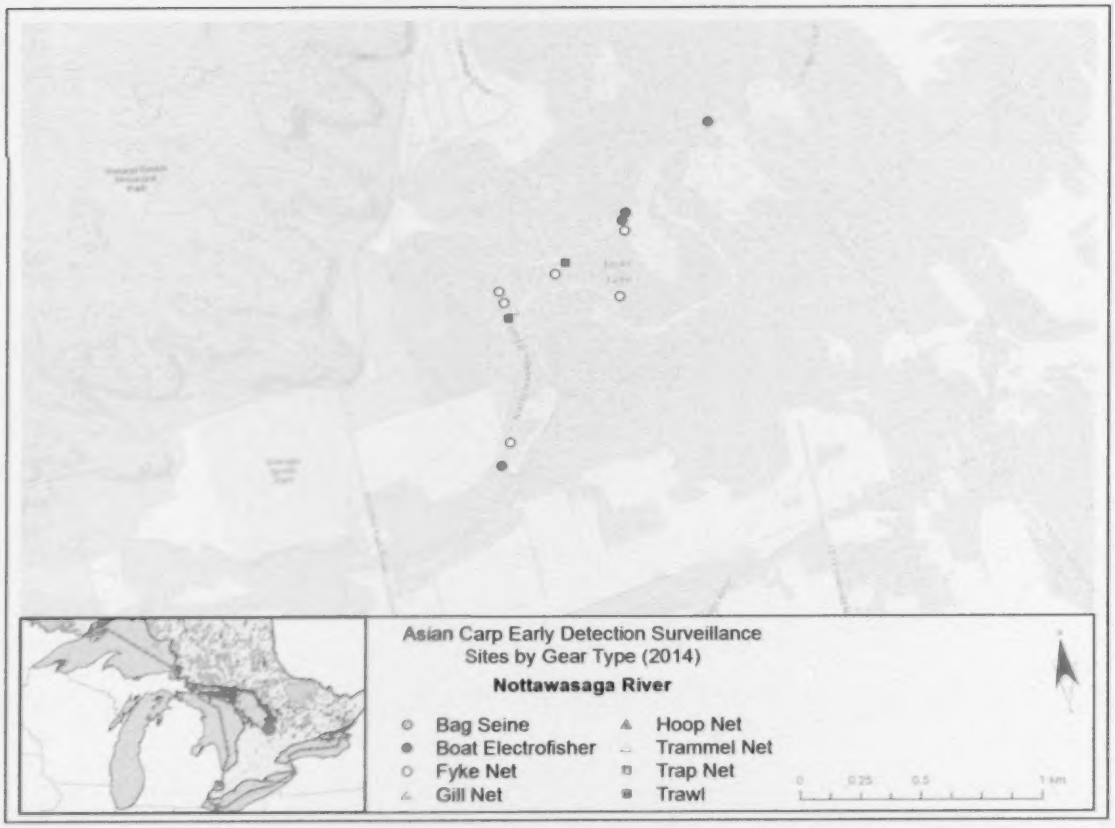

Figure 27. Asian Carp Program early detection surveillance sites, and gear types used, in the Nottawasaga River in 2014.

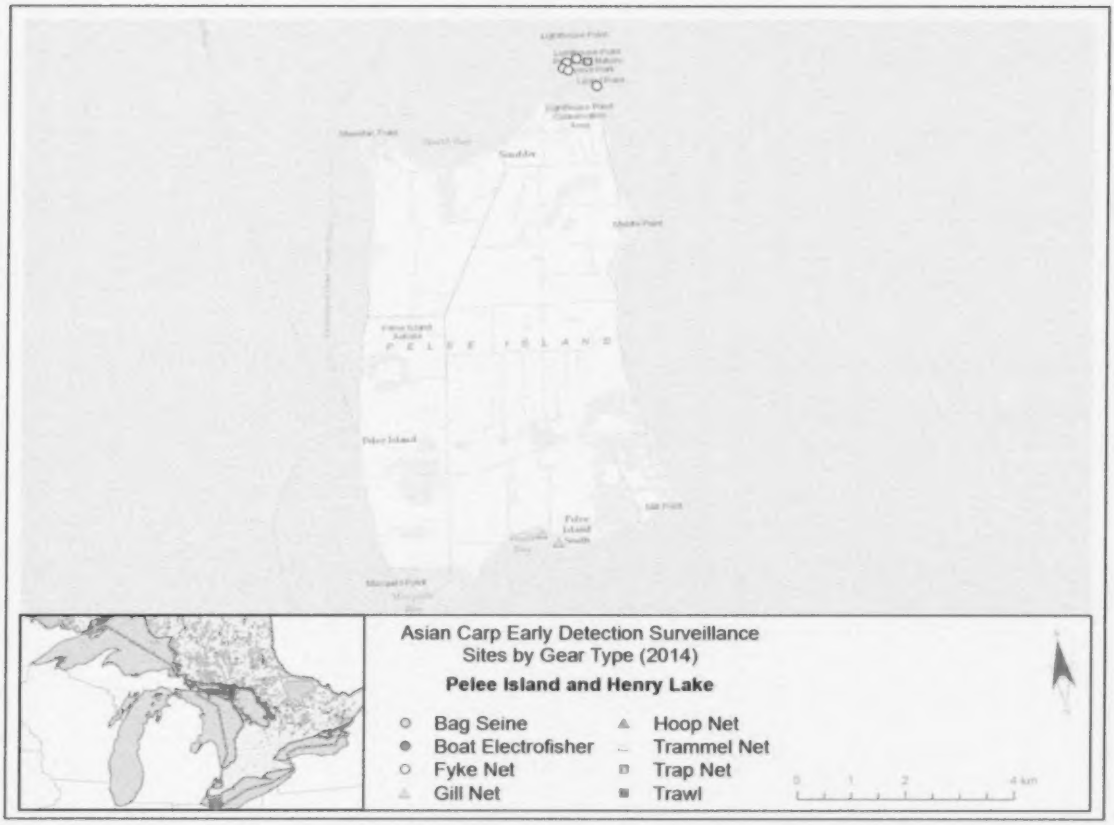

Figure 28. Asian Carp Program early detection surveillance sites, and gear types used, on Pelee Island (Lake Henry) and in Lake Erie in 2014.

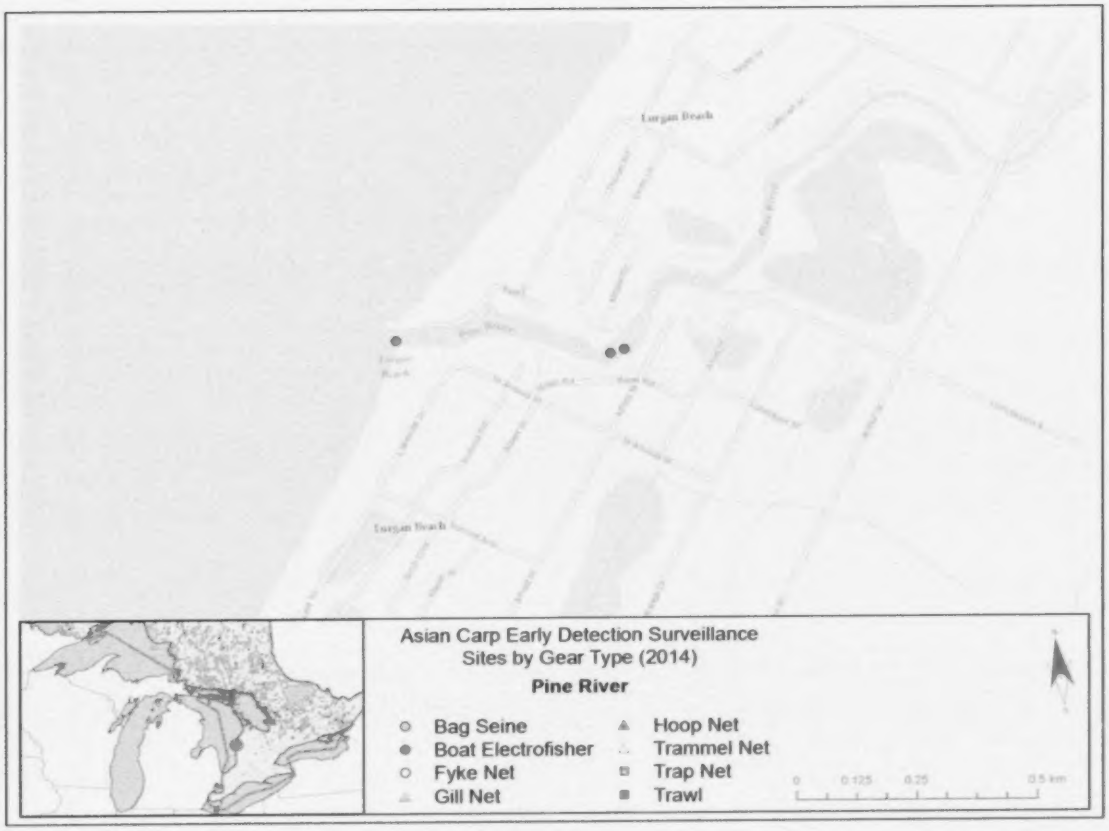

Figure 29. Asian Carp Program early detection surveillance sites, and gear types used, in the Pine River in 2014.

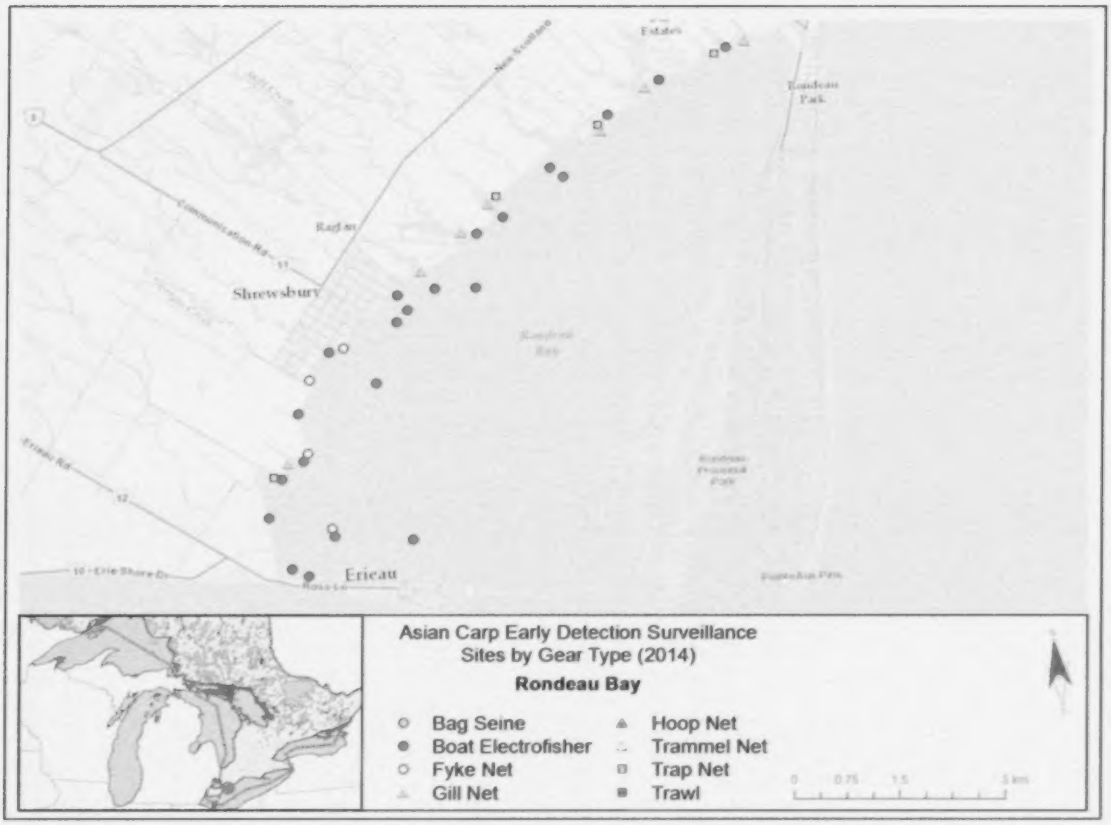

Figure 30. Asian Carp Program early detection surveillance sites, and gear types used, in Rondeau Bay in 2014.

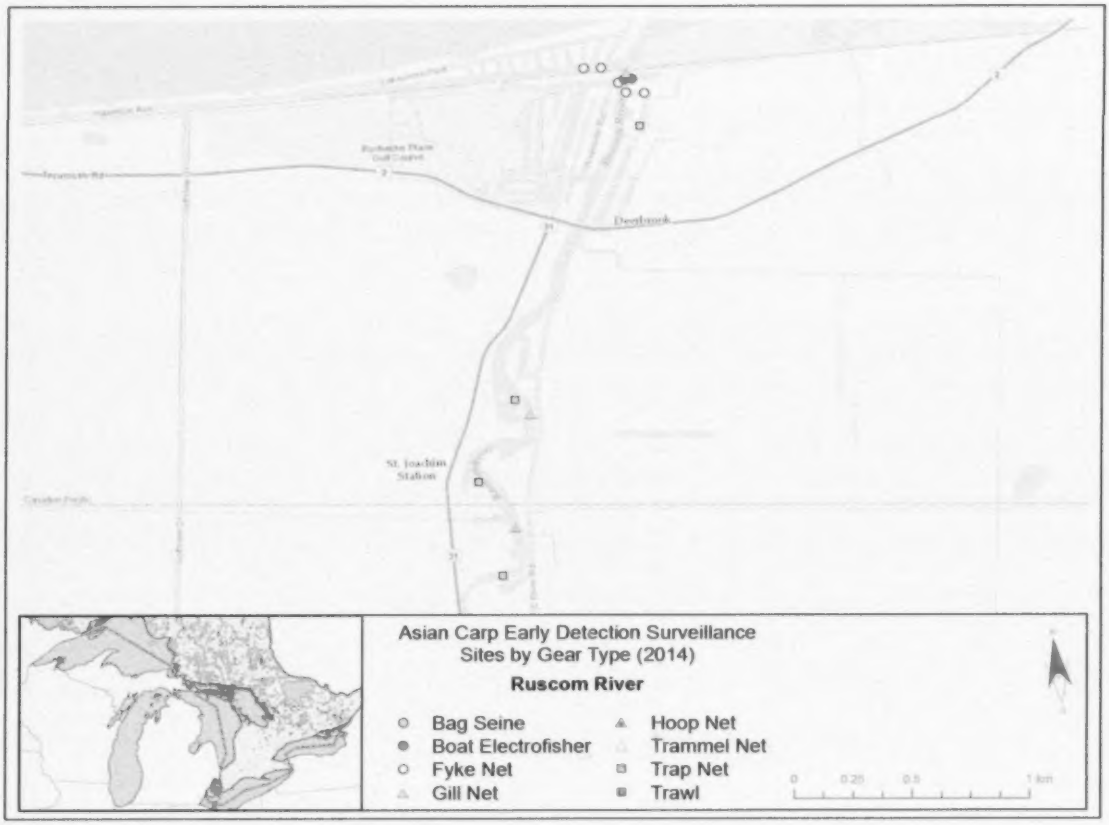

Figure 31. Asian Carp Program early detection surveillance sites, and gear types used, in the Ruscom River in 2014.

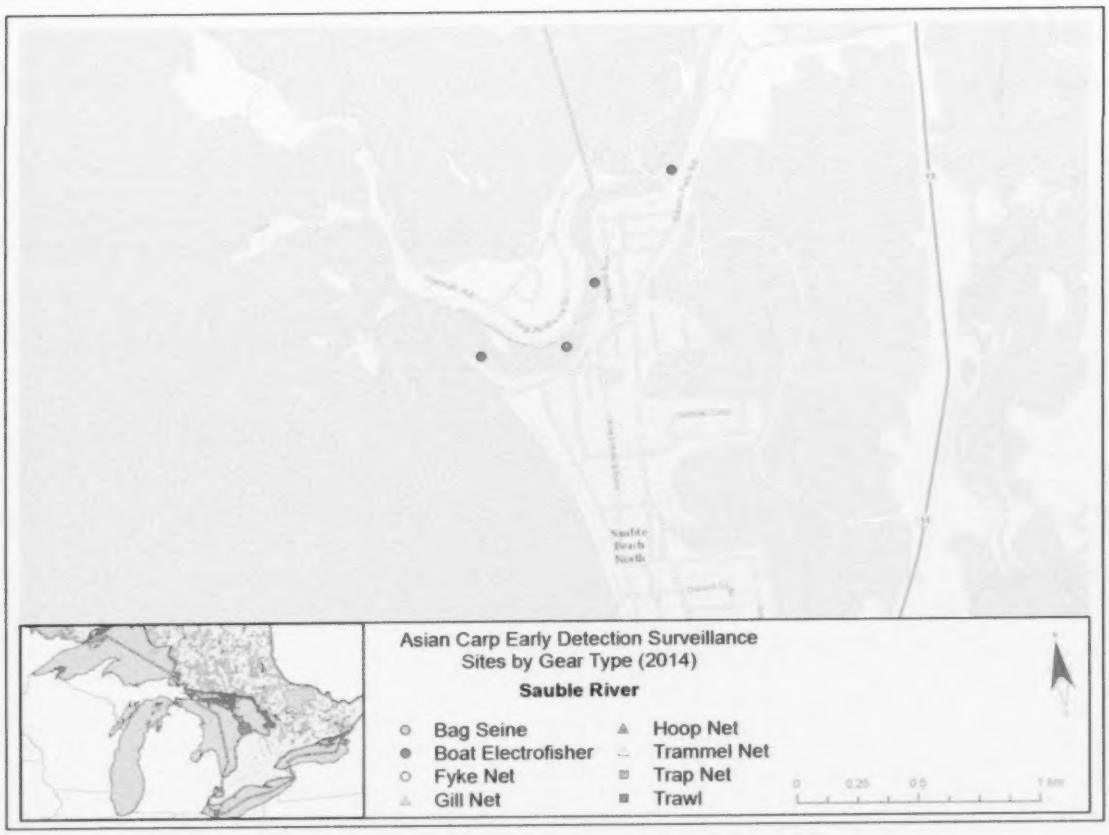

Figure 32. Asian Carp Program early detection surveillance sites, and gear types used, in the Sauble River in 2014.

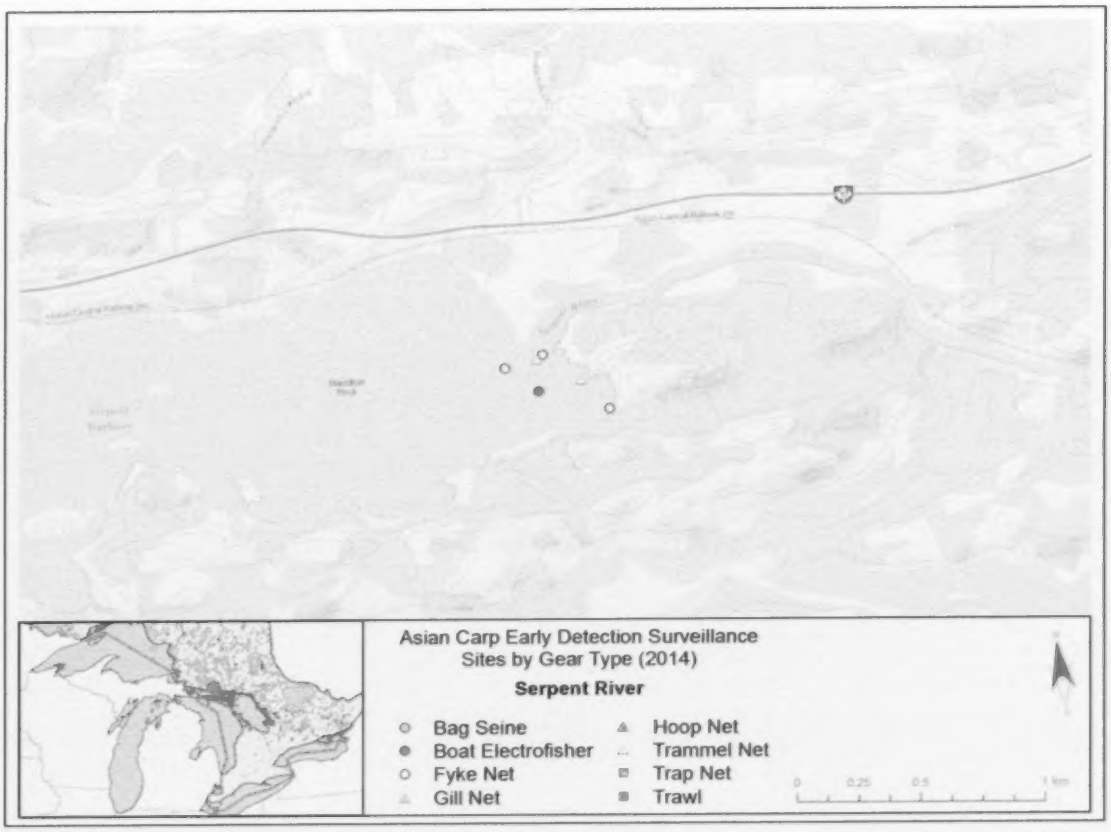

Figure 33. Asian Carp Program early detection surveillance sites, and gear types used, in the Serpent River in 2014.

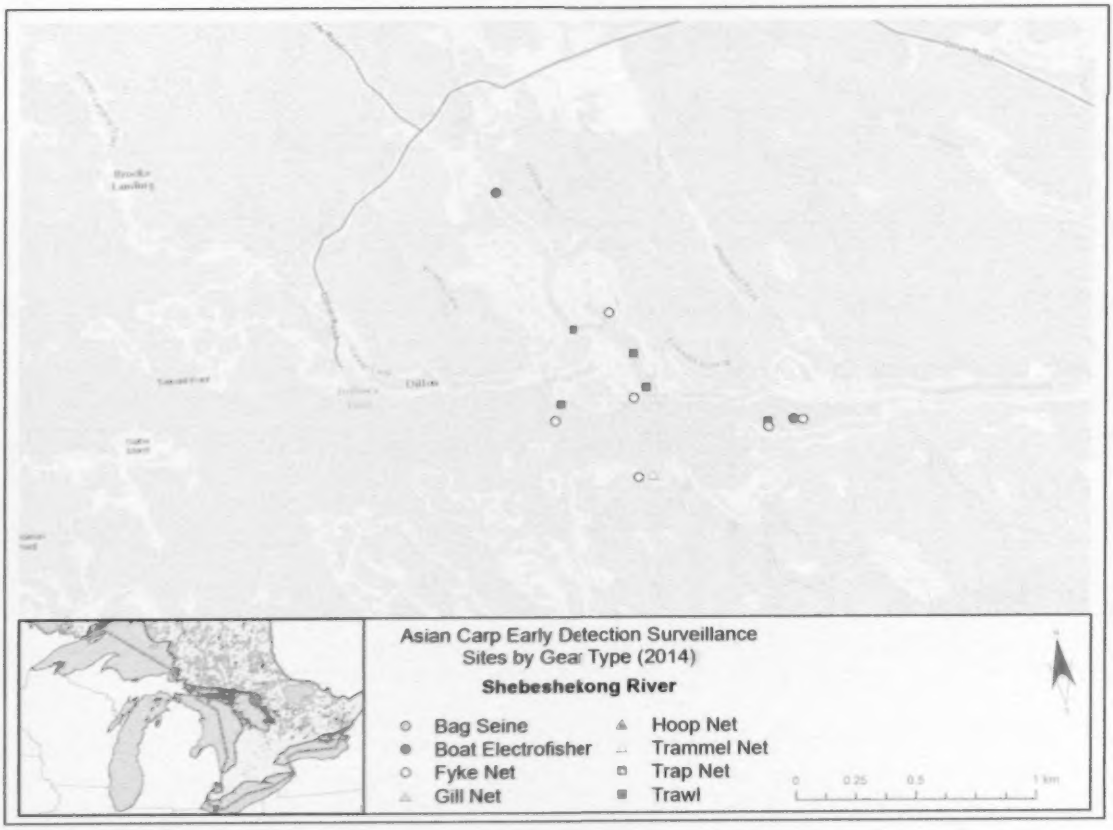

Figure 34. Asian Carp Program early detection surveillance sites, and gear types used, in the Shebeshekong River in 2014.

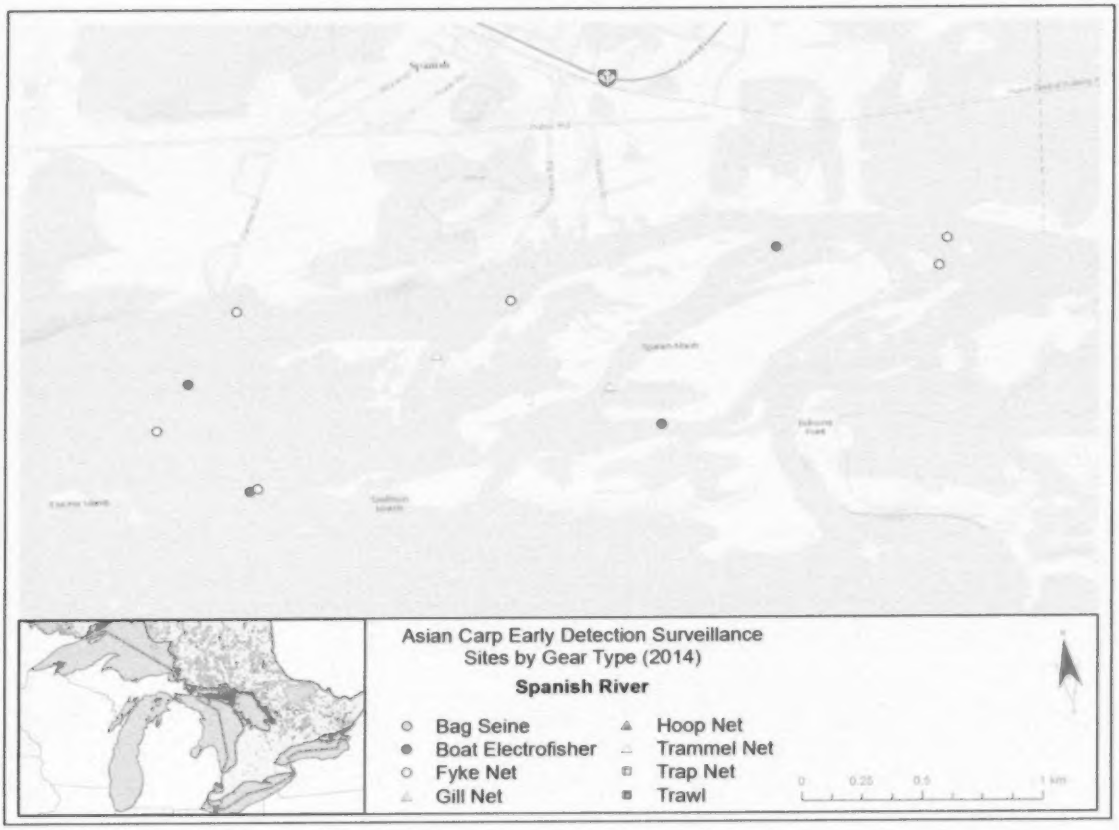

Figure 35. Asian Carp Program early detection surveillance sites, and gear types used, in the Spanish River in 2014.

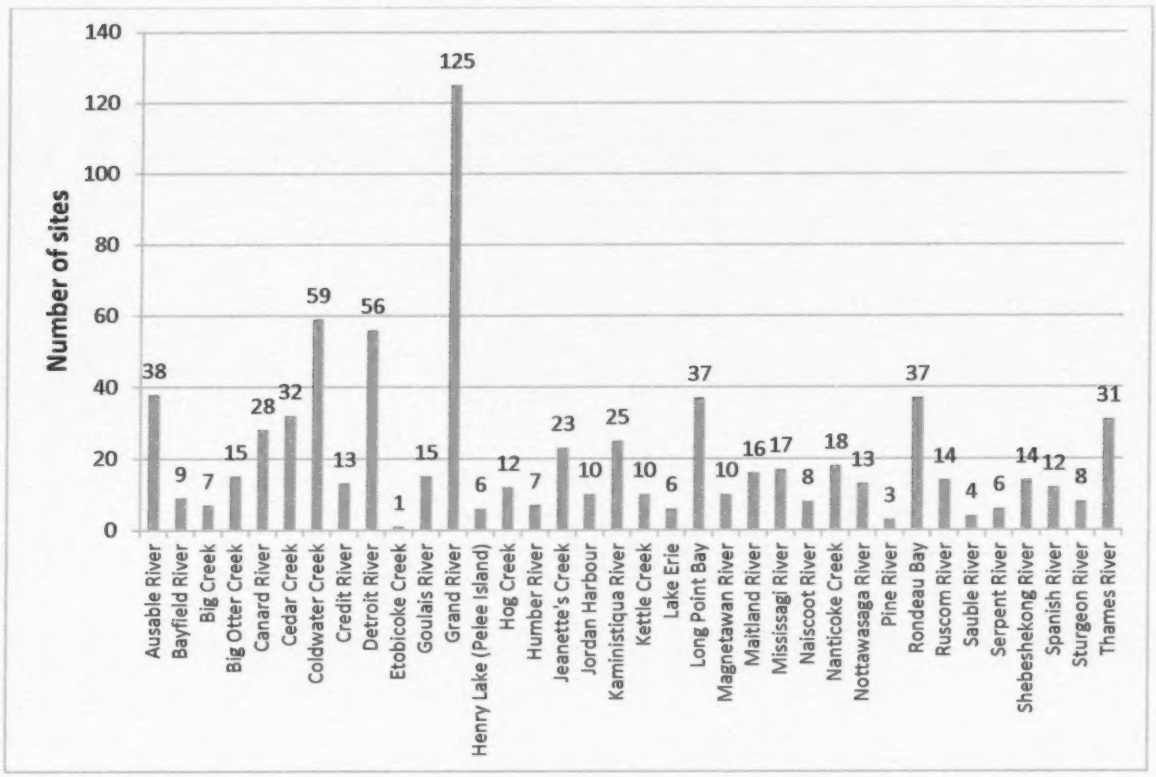

Figure 36. Number of sites sampled by waterbody in 2014 Asian carp early detection surveillance.

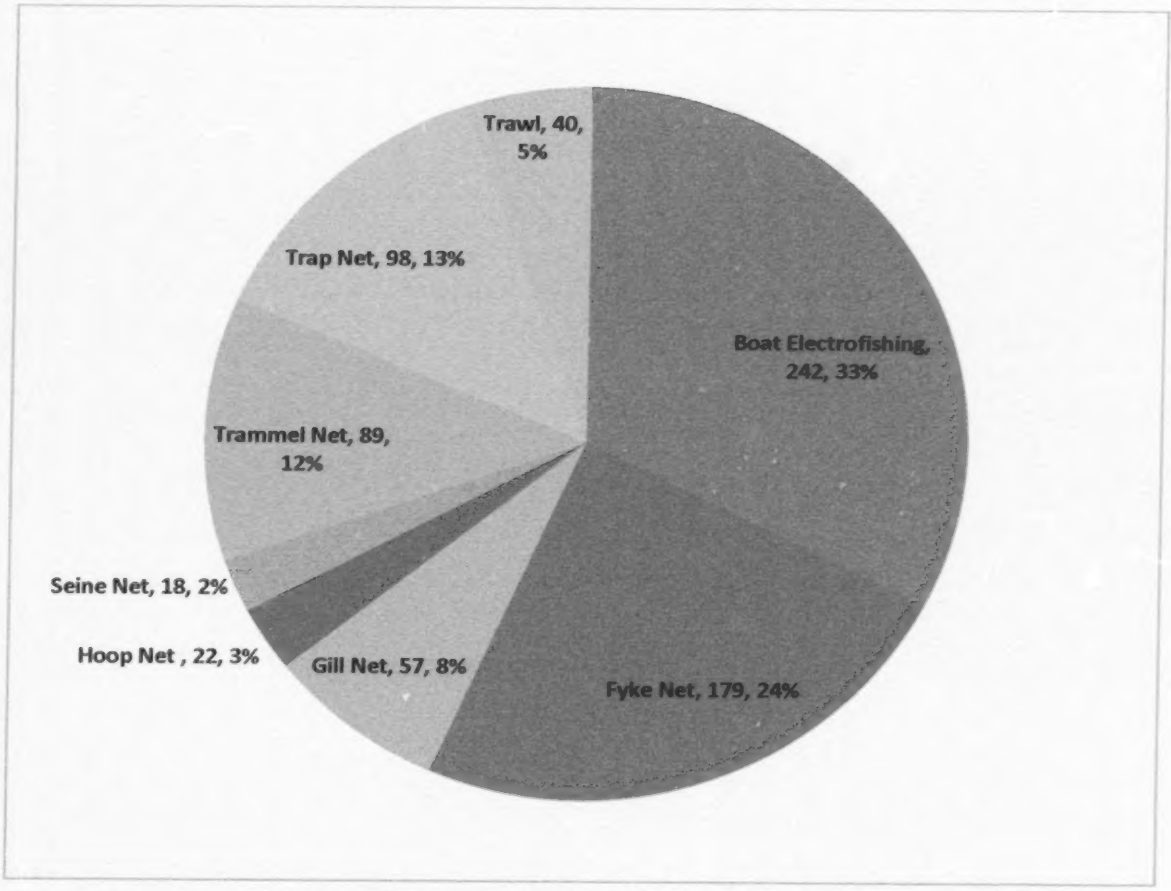

Figure 37. Number of sites by gear type in 2014 Asian carp early detection surveillance.

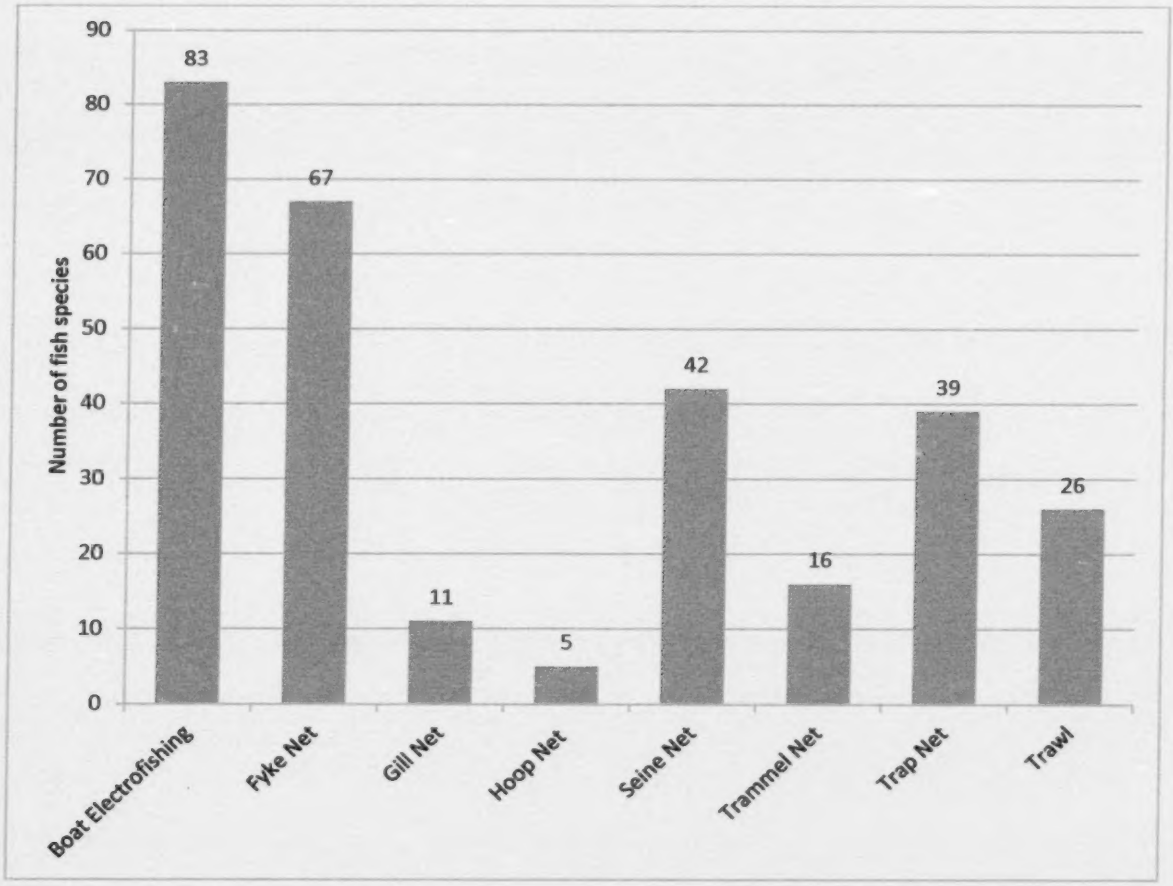

Figure 38. Number of species captured by gear type in 2014 Asian carp early detection surveillance.

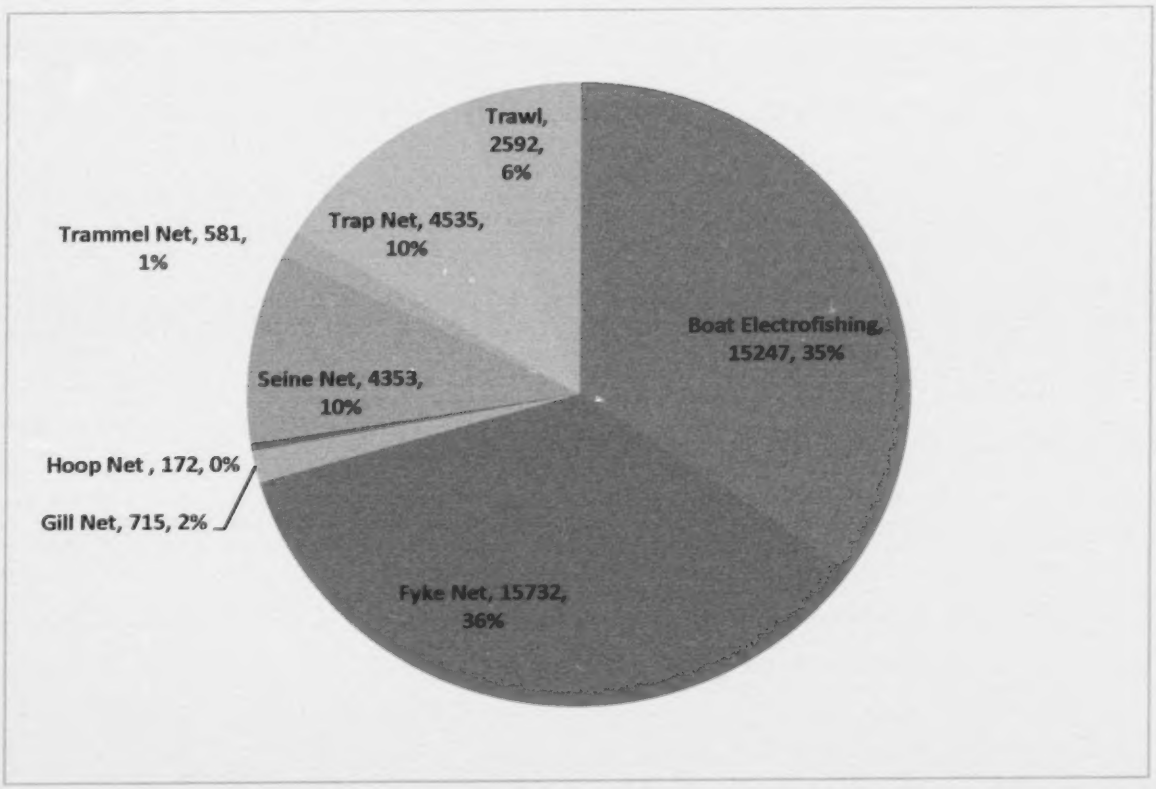
Trawl, 2592, 6%
Trammel Net, 581, 1%
Trap Net, 4535, 10%
Boat Electrofishing, 15247, 35%
Seine Net, 4353, 10%
Hoop Net , 172, 0%
Gill Net, 715, 2%
Fyke Net, 15732, 36%

Figure 39. Number of fishes captured by gear type in 2014 Asian carp early detection surveillance.

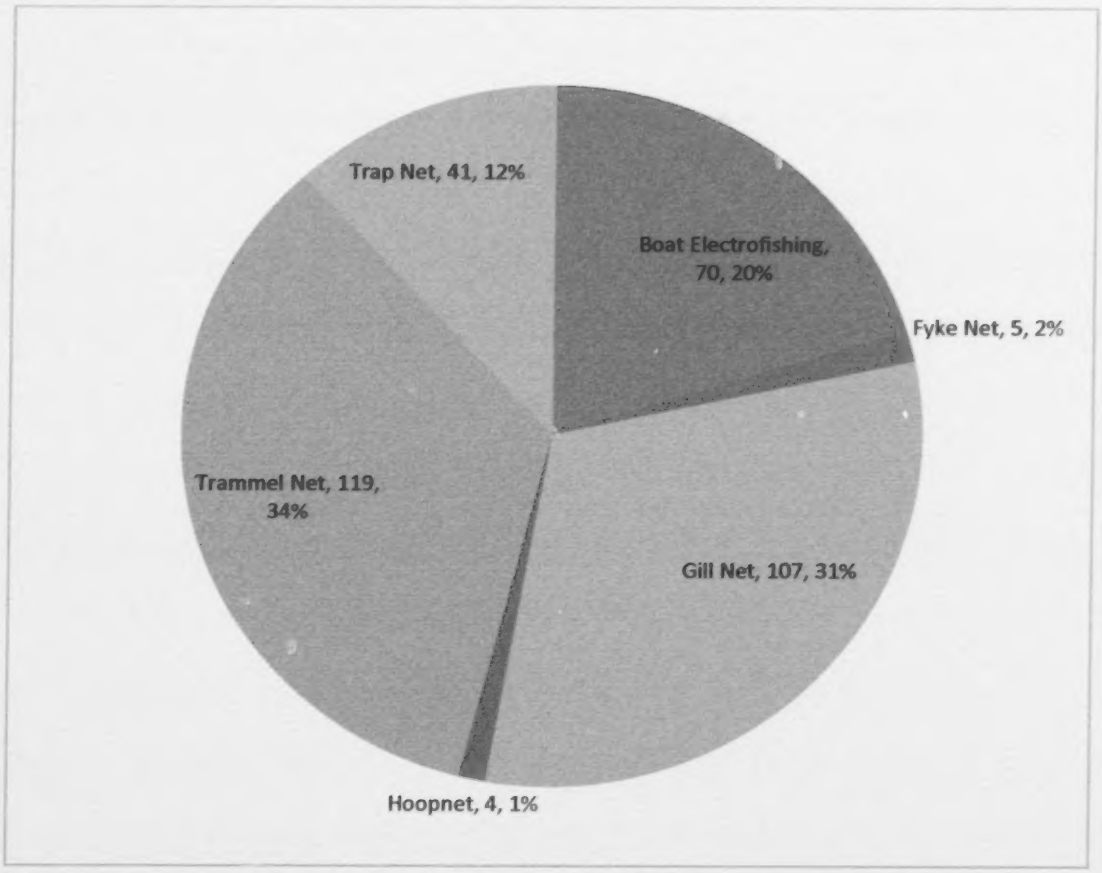

Figure 40. Surrogate species (Buffalo: Ictiobus spp.) captured by gear type during Asian carp early detection surveillance 2014.

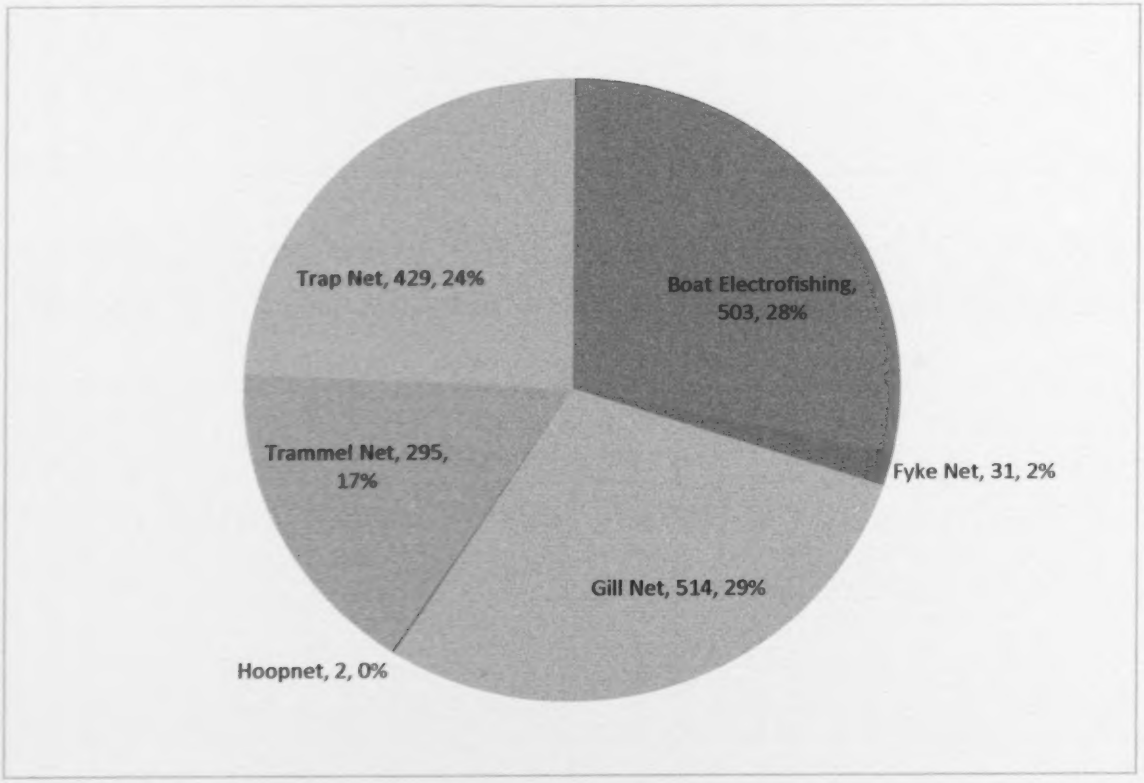

Figure 41. Number of Asian carp surrogate species (Common Carp) captured by gear type during the 2014 Asian carp early detection surveillance sampling.

TABLES

Table 1. Summary of the species captured during the 2014 Asian Carp Program early detection surveillance field season. Common and scientific names according to Holm et al. 2010 and Nelson et al. 2003.

Common Name	Scientific Name	Number of Specimens
Alewife	*Alosa pseudoharengus*	15
American Brook Lamprey	*Lampetra appendix*	1
American Eel	*Anguilla rostrata*	1
Banded Killifish	*Fundulus diaphanus*	29
Basses and Sunfishes species	*Centrarchidae*	8
Bigmouth Buffalo **	*Ictiobus cyprinellus*	150
Black Bullhead	*Ameiurus melas*	70
Black Crappie	*Pomoxis nigromaculatus*	393
Black Redhorse	*Moxostoma duquesnei*	51
Blackchin Shiner	*Notropis heterodon*	144
Blacknose Dace	*Rhinichthys atratulus*	1
Blacknose Shiner	*Notropis heterolepis*	33
Blackside Darter	*Percina maculata*	1
Bluegill	*Lepomis macrochirus*	4238
Bluntnose Minnow	*Pimephales notatus*	1845
Bowfin	*Amia calva*	678
Brook Silverside	*Labidesthes sicculus*	82
Brook Stickleback	*Culaea inconstans*	1
Brown Bullhead	*Ameiurus nebulosus*	1689
Brown Trout	*Salmo trutta*	2
buffalo species **	*Ictiobus* spp.	196
Central Mudminnow	*Umbra limi*	37
Central Stoneroller	*Campostoma anomalum*	1
Channel Catfish	*Ictalurus punctatus*	476
Coho Salmon	*Oncorhynchus kisutch*	4
Common Carp **	*Cyprinus carpio*	1774
Common or Striped Shiner	*Luxilus* sp.	1
Common Shiner	*Luxilus cornutus*	231
crappie species	*Pomoxis* sp.	1
Creek Chub	*Semotilus atromaculatus*	20
darter species	*Percidae* sp.	1
Emerald Shiner	*Notropis atherinoides*	5201
Fathead Minnow	*Pimephales promelas*	247
Freshwater Drum	*Aplodinotus grunniens*	267
Ghost Shiner	*Notropis buchanani*	7
Gizzard Shad	*Dorosoma cepedianum*	2518

Common Name	Scientific Name	Number of Specimens
Golden Redhorse	*Moxostoma erythrurum*	91
Golden Shiner	*Notemigonus crysoleucas*	397
Goldfish	*Carassius auratus*	193
Goldfish x Common Carp hybrid	*Carassius auratus X Cyprinus carpio*	75
Grass Carp*	*Ctenopharyngodon idella*	1
Greater Redhorse	*Moxostoma valenciennesi*	3
Green Sunfish	*Lepomis cyanellus*	13
Green Sunfish x Bluegill	*Lepomis cyanellus X Lepomis macrochirus*	6
Greenside Darter	*Etheostoma blennioides*	5
Hornyhead Chub	*Nocomis biguttatus*	6
Iowa Darter	*Etheostoma exile*	8
Johnny Darter	*Etheostoma nigrum*	1474
Lake Herring	*Coregonus artedi*	2
Lake Sturgeon	*Acipenser fulvescens*	9
Lake Trout	*Salvelinus namaycush*	4
Largemouth Bass	*Micropterus salmoides*	2317
Logperch	*Percina caprodes*	343
Longnose Dace	*Rhinichthys cataractae*	2
Longnose Gar	*Lepisosteus osseus*	587
Mimic Shiner	*Notropis volucellus*	2166
Minnow sp.	*Cyprinid* sp.	29
Mooneye	*Hiodon tergisus*	1
Mottled Sculpin	*Cottus bairdii*	17
Muskellunge	*Esox masquinongy*	15
Northern Hog Sucker	*Hypentelium nigricans*	23
Northern Pike	*Esox lucius*	156
Northern Sunfish	*Lepomis peltastes*	244
Orangespotted Sunfish	*Lepomis humilis*	4
Pink Salmon	*Oncorhynchus gorbuscha*	1
Pugnose Shiner	*Notropis anogenus*	9
Pumpkinseed	*Lepomis gibbosus*	2794
Pumpkinseed x Northern Sunfish	*Lepomis gibbosus X Lepomis peltastes*	10
Quillback	*Carpiodes cyprinus*	815
Rainbow Smelt	*Osmerus mordax*	42
Rainbow Trout	*Oncorhynchus mykiss*	18
redhorse species	*Moxostoma* sp.	15
Rock Bass	*Ambloplites rupestris*	714
Rosyface Shiner	*Notropis rubellus*	21
Round Goby	*Neogobius melanostomus*	912

Common Name	Scientific Name	Number of Specimens
Rudd	*Scardinius erythrophthalmus*	39
Ruffe	*Gymnocephalus cernua*	7
Sand Shiner	*Notropis stramineus*	2
Sculpin species	*Cottus* sp.	1
Shorthead Redhorse	*Moxostoma macrolepidotum*	111
Silver Lamprey	*Ichthyomyzon unicuspis*	4
Silver Redhorse	*Moxostoma anisurum*	132
Slimy Sculpin	*Cottus cognatus*	1
Smallmouth Bass	*Micropterus dolomieu*	550
Spotfin Shiner	*Cyprinella spiloptera*	437
Spottail Shiner	*Notropis hudsonius*	656
Spotted Gar	*Lepisosteus oculatus*	24
Spotted Sucker	*Minytrema melanops*	36
Stonecat	*Noturus flavus*	3
Striped Shiner	*Luxilus chrysocephalus*	231
sucker species	*Catostomus* sp.	1
sunfish hybrids	*Lepomis hybrid*	2
sunfish species	*Lepomis* sp.	2141
Tadpole Madtom	*Noturus gyrinus*	35
Three-spined Stickleback	*Gasterosteus aculeatus*	1
Trout-Perch	*Percopsis omiscomaycus*	35
Tubenose Goby	*Proterorhinus semilunaris*	12
Walleye	*Sander vitreus*	119
Warmouth	*Lepomis gulosus*	4
White Bass	*Morone chrysops*	169
White Crappie	*Pomoxis annularis*	116
White Perch	*Morone americana*	80
White Sucker	*Catostomus commersonii*	543
Yellow Bullhead	*Ameiurus natalis*	122
Yellow Perch	*Perca flavescens*	4358
Total		**43928**

*one triploid Grass Carp was captured in the Grand River.
** surrogate species for Asian carps

Table 2. Summary of the 2014 catch data for the Asian Carp Program.

Catch Data	Total
Total number of sites	745
Total number of waterbodies	36
Total species caught	92
Total fishes caught	43928
Total number of surrogates caught	2120
Total number of Asian carps caught	1
Mean fishes caught per waterbody	1220.22
Mean fishes caught per site	58.96
Minimum fishes caught per waterbody	79
Maximum fishes caught per waterbody	10948

Table 3. Summary of the catch data by gear types used in the 2014 Asian Carp Program.

Gear type	Total Effort	Effort Unit	# Sites	# Species	# Fishes	# Buffalo	# Common Carp	# Asian Carps
Boat Efishing	173682	seconds	242	83	15247	70	503	0
Fyke Net	3710.03	hrs	179	67	15732	5	31	0
Gill Net	1716/ 10424.16	mins/m	57	11	715	107	514	0
Hoop Net	544.37	hrs	22	5	172	4	2	0
Seine Net	34	hauls	18	42	4353	0	0	0
Trammel Net	3300/ 16276.32	mins/m	89	16	581	119	295	1
Trap Net	2076.63	hrs	98	39	4535	41	429	0
Trawl	40	hauls	40	26	2592	0	0	0
Total			745	378	43928	347	1774	1

*Table 4. Catch data by waterbody for the 2014 Asian Carp Program. * Does not include any hybrids in total species (subterminal mouth Buffalo are considered as one species, and terminal mouth Bigmouth Buffalo as a separate species)*

Waterbody	Total # fish species	Total # fishes	Total # sites	Total # Buffalo spp.	Total # Common Carp	Total # Asian Carps
Ausable River	35	858	38	12	45	
Bayfield River	25	228	9	0	8	
Big Creek	17	105	7	1	42	
Big Otter Creek	29	1138	15	0	16	
Canard River	32	1997	28	42	141	
Cedar Creek	31	1472	32	65	592	
Coldwater Creek	36	2734	59	0	72	
Credit River	16	246	13	0	24	
Detroit River	43	2242	56	46	172	
Etobicoke Creek	5	100	1	0	0	
Goulais River	21	2139	15	0	1	
Grand River	55	10948	125	71	195	1
Hog Creek	18	871	12	0	0	
Humber River	18	1001	7	0	4	
Jeanette's Creek	35	1111	23	19	56	
Jordan Harbour	31	432	10	21	36	
Kaministiqua River	20	434	25	0	9	
Kettle Creek	16	79	10	2	15	
Lake Erie	3	108	6	6	96	
Henry Lake (Point Pelee)	11	335	6	0	1	
Long Point Bay	35	2072	37	0	15	
Magnetawan River	24	752	10	0	1	
Maitland River	27	1139	16	0	2	
Mississagi River	18	2604	17	0	0	
Naiscoot River	11	648	8	0	0	
Nanticoke Creek	29	408	18	0	17	
Nottawasaga River	25	477	13	0	10	
Pine River	12	86	3	0	1	
Rondeau Bay	30	1801	37	0	36	
Ruscom River	23	549	14	1	30	
Sauble River	19	94	4	0	0	
Serpent River	19	141	6	0	0	

Waterbody	Total # fish species	Total # fishes	Total # sites	Total # Buffalo spp.	Total # Common Carp	Total # Asian Carps
Shebeshekong River	25	1483	14	0	0	
Spanish River	24	595	12	0	1	
Sturgeon River	25	1006	8	0	0	
Thames River	32	1494	31	60	136	
Total	**92***	**43928**	**745**	**346**	**1774**	**1**

Table 5. Sampling effort by waterbody for Boat Electrofishing (BEF), Trammel netting (TRM), Tied-down Gill Netting (GN), and Fyke netting (MFN), during 2014 Asian carp surveillance sampling.

Waterbody Name	BEF # sites	BEF Effort (Secs)	TRM # sites	TRM Effort (mins and m of net)	GN # sites	GN effort (mins and m of net)	MFN # sites	MFN effort (hrs)
Ausable River	14	8493	12	281/2194.56			8	150.89
Bayfield River	3	1673	1	25/182.88			3	52.32
Big Creek	5	3000	1	17/182.88				
Big Otter Creek	7	4198			3	124/548.64	3	69.05
Canard River	8	4800	8	268/1463.04	1	46/182.88	4	71.92
Cedar Creek			10	356/1828.8	4	215/731.52	6	107.17
Coldwater Creek	20	12113	3	30/548.64			18	374.74
Credit River					5	102/914.4	5	105.54
Detroit River	24	14659	8	765/1463.04	9	229/1645.92	4	91.3
Etobicoke Creek								
Goulais River	2	1200	3	33/548.64			6	124.11
Grand River	34	20481	21	1096/3840.48	8	181/1463.04	26	519.46
Henry Lake (Pelee Island)							5	118.67
Hog Creek	3	5656	2	27/365.76			5	99.16
Humber River					3	42/548.64	2	47.19
Jeanette's Creek	10	5999	2	45/365.76			7	186.89
Jordan Harbour					2	44/365.76	4	83.67

Waterbody Name	BEF # sites	BEF Effort (Secs)	TRM # sites	TRM Effort (mins and m of net)	GN # sites	GN effort (mins and m of net)	MFN # sites	MFN effort (hrs)
Kaministiqua River	7	11108					5	85.43
Kettle Creek	4	2328			4	242/731.52	2	36.56
Lake Erie			2	75/365.76	4	122/731.52		
Long Point Bay	20	12010	2	72/365.76	2	60/365.76	10	209.91
Magnetawan River	2	3613					3	54.26
Maitland River	6	3619	3	49/548.64			3	42.43
Mississagi River	3	4497					6	149.27
Naiscoot River			1	10/182.88			3	55.43
Nanticoke Creek	6	3209					8	168.96
Nottawasaga River	4	6273	1	10/182.88			6	127.97
Pine River	3	1800						
Rondeau Bay	22	13200			7	129/1280.16	4	91.66
Ruscom River	2	1200			3	145/548.64	5	105.99
Sauble River	4	2400						
Serpent River	1	1302	2	20/365.76			3	61.94
Shebeshekong River	2	3414	1	10/182.88			6	119.28
Spanish River	4	6572	2	29/365.76			6	126.43
Sturgeon River	3	3527	1	10/182.88			3	72.43
Thames River	19	11338	3	72/548.64	2	35/365.76		
Total	**242**	**173682**	**89**	**3300/16276.32**	**57**	**1716/1042 4.16**	**179**	**3710.03**

Table 6. Sampling effort by waterbody for Seining (SN), Hoop netting (HN), Trap netting (TN) and Trawling (TRL), during 2014 Asian carp surveillance sampling.

Waterbody Name	SN # sites	SN effort (# hauls)	HN# sites	HN effort (hrs)	TN # sites	TN effort (hrs)	TRL # sites	TRL Effort (hauls)
Ausable River					4	80.41		
Bayfield River	1	3			1	18.11		
Big Creek					1	21.5		
Big Otter Creek			1	20.1	1	19.35		
Canard River					7	156.04		
Cedar Creek					12	257.23		
Coldwater Creek	1	3			11	236.22	6	6
Credit River					3	60.85		
Detroit River			5	121.99	6	128.46		
Etobicoke Creek	1	3						
Goulais River	4	4						
Grand River	2	6	12	241.51	22	461.25		
Henry Lake (Pelee Island)					1	21.33		
Hog Creek							2	2
Humber River					2	47.6		
Jeanette's Creek			1	48.38	3	66.46		
Jordan Harbour					4	84.31		
Kaministiqua River	3	3					10	10
Kettle Creek								
Lake Erie								
Long Point Bay					3	63.57		
Magnetawan River							5	5
Maitland River	3	9			1	22.42		
Mississagi River	2	2					6	6
Naiscoot River							4	4
Nanticoke Creek					4	83.03		
Nottawasaga River							2	2
Pine River								
Rondeau Bay					4	84.4		
Ruscom River					4	72.71		
Sauble River								

Waterbody Name	SN # sites	SN effort (# hauls)	HN# sites	HN effort (hrs)	TN # sites	TN effort (hrs)	TRL # sites	TRL Effort (hauls)
Serpent River								
Shebeshekong River							5	5
Spanish River								
Sturgeon River	1	1						
Thames River			3	112.39	4	91.38		
Total	**18**	**34**	**18**	**383.6**	**98**	**2076.63**	**40**	**40**